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FROM CELLULOID REALITIES TO BINARY DREAMSCAPES: CINEMA AND PERCEPTUAL EXPERIENCE IN THE AGE OF DIGITAL IMMERSION

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THESIS

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ABSTRACT OF THESIS

FROM CELLULOID REALITIES TO BINARY DREAMSCAPES: CINEMA AND PERCEPTUAL EXPERIENCE IN THE AGE OF DIGITAL IMMERSION

Technologies in digital cinema are quickly changing the way contemporary filmmakers create films and how audiences currently perceive them. As we move onward into the digital turn, it becomes ever more apparent that the medium of film has been emancipated from its dependence on the photograph. Directors are no longer required to capture the objectively real as it sits before the photographic lens, but can essentially construct it via groundbreaking advancements in computer-generated imagery, motion capture technology, and digital 3D camera systems and display technologies. Since the origins of film, spectators and filmmakers have assumed an existing relationship between reality and the photographic image. Yet digital film technologies now provide us with hyper-facsimiles of reality that are perceived as photographic, but are often created by way of computer processes. Digital cinema currently allows the viewer to inhabit and interact with cinematic realities in unprecedented ways, and it is this contemporary paradigmatic shift from the analog to the digital that has catalyzed fundamentally new ways of looking at the filmic image. In this paper, I will examine the perceptual complexities of contemporary digital film through the lens of these cinematic technologies by examining their impact on the viewer's experience.

KEYWORDS: Digital Cinema, Computer-Generated Imagery, Motion Capture, Digital 3D, Virtual Reality

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Chapter One: Introduction

Innovations in digital cinema are rapidly altering the manner in which contemporary filmmakers create films and how audiences now perceive them. As we move increasingly onward into the digital turn, it becomes ever more apparent that traditional processes of understanding analog film have been turned on their heads. Perhaps for the first time in cinematic history, one can now easily assert that the medium of film has been emancipated from its dependence on the photographic image. Directors are no longer required to capture the objectively real as it sits before the camera lens, but can actually build it using computer-generated imagery (CGI) and skilled visual effects personnel.

This is perhaps nowhere more apparent than in James Cameron's sci-fi epic *Avatar* (2009), a film in which the spectator is able to perceive fantastical, digitally-rendered realities as if they were captured by the photographic lens of the conventional movie camera. Likewise, the live actor can now depart considerably from the photographic reality of analog film by masking their face and body as an entirely digital character by way of innovations in motion capture technology, allowing spectators to perceive imagined, virtual bodies on screen with the same emotional intensity of a movie star photographically reproduced in the flesh. And when filmed using digital 3D camera systems, these forms of cinematic representation are now nearly holographic. They provide a convincing depth of field and visual completeness that immerses the spectator into a virtual simulation of the real; a far cry from the contrived sequences of previously established modes of theatrical stereoscopy. One could say that with the current standardization of these digital technologies, filmmakers are advancing innovative

models of cinematic representation that are no longer solely connected to the indexicality of the photographic image.

However, this transition from analog to digital film practices has created significant issues for conventional film theories that have considered the photograph as a basis for understanding the ontology of the medium. The problem ultimately stems from a reconstruction of the paradigmatic scaffolding that has for so long supported our understanding of cinematic realism. Since the origins of the moving picture, both spectators and filmmakers have assumed an existing relationship between reality and the photographic image captured by the camera lens. Paradoxically, however, digital film technologies can now easily provide us with hyper-facsimiles of reality that are perceived as photographic, and carry the same precise level of visual information as such, but are often created via computer processes.

With the recent release of films such as *Avatar* (2009), *Rise of the Planet of the Apes* (2011), *Hugo* (2011), and *The Adventures of Tintin* (2011), the presentation of these virtual, cinematic realities has reached an unprecedented level, leading increasingly to an amalgam between the real and an artificial likeness. This confluence between reality and a simulation of the real, which is currently achievable through the use of digital technologies like CGI, motion capture, and digital stereoscopy, is beginning to vastly change the way in which spectators perceive the filmic image. It raises the all-important question: how can one begin to develop a new understanding of film in an age where digital technologies are beginning to eliminate all traces of analog forms of cinematic representation?

This paradigmatic shift toward a digital cinema has encouraged a number of film theorists to address the ambivalence that now exists between reality and the realistic simulations actualized through these new digital film technologies.[1] In his seminal essay "True Lies: Perceptual Realism, Digital Images, and Film Theory," Stephen Prince observes that the ontology of the computer-generated image is not framed in terms of the indexical photograph, but rather by how the image corresponds to the viewer's own visual and social real-world surroundings.[2] As a perceptually realistic image, the CG Velociraptors in a film like *Jurassic Park* (1993) can be judged as having a photographic likeness in the way they provide visual cues to the viewer's own observable experience of the world; the course texture of their skin, the way light reflects off their bodies, and their predatory gestures are painted by the digital artist to reflect our previous conceptions of how a dinosaur, however unreal, would exist in reality.

Gabriel Giralt in "Realism and Realistic Representation in the Digital Age" suggests that regardless of its photographic or digitally-rendered status, we perceive the filmic image not as a pure representation of reality, but rather as a medium that communicates certain represented realities to the viewer. To Giralt, digital cinema does

[1] The theoretical works mentioned in this introduction reflect only a sampling of film theorists that I feel have provided seminal contributions to the understanding of digital, cinematic technologies and our contemporary perceptions of them. There have been numerous other theorists that have helped foster the current scholarly discourse that revolves around digital film, virtual worlds, and spectatorial practice of such. For a deeper understanding of the type of grammar that is developing around these digital media, see: D.N. Rodowick, "Dr. Strange Media; or How I Learned to Stop Worrying and Love Film Theory," *PMLA*, 116, no. 5 (2001): 1396-1404, Stephen Prince, "The Emergence of Filmic Artifacts," *Film Quarterly*, 57, no. 3 (2004): 24-33, and Jean-Pierre Geuens, "The Digital World Picture," *Film Quarterly*, 55, no. 4 (2002): 16-27. Also extremely helpful to the understanding of film's current paradigmatic shift to the digital is Lev Manovich's *The Language of New Media*, particularly chapter 4 "The Illusions" which gives an intriguing overview of digital technologies and the type of "digital realism" inherent to their manner of representation. Also relevant is Philip Rosen's *Change Mummified: Cinema, Historicity, Theory* especially chapter 8 "Old and New: Image, Indexicality, and Historicity in the Digital Utopia."

[2] Stephen Prince, "True Lies: Perceptual Realism, Digital Images, and Film Theory," *Film Quarterly*, 49, no. 3 (1996): 27-37, 32.

not supply us with an understanding of the real world, but instead elicits emotions from the spectator that either attracts them to, or repels them from, the cinematic reality on screen.[3]

In his article "The Emergence of a Digital Cinema," Roger B. Wyatt argues that the paradigmatic transformation from analog to digital film has acted as a catalyst for new modes of artistic representation, namely those that have emerged as a result of computer software and the digital artist's ability to manipulate images appropriated from reality.[4]

Although these theorists have sought to address the ambiguous nature of cinema as it currently stands in the digital turn, I would like to point out that none have yet to examine the complexities of digital film through the lens of the combined technologies mentioned in this paper, namely the intersections between computer-generated images, motion capture technology, and their visual augmentation through advancements in digital 3D display and filming technologies. This paper will address this omission by examining the impact of these technological innovations on the viewer's experience. The fundamental questions raised are how might our response to those digital technologies differ from our response to analog film formats, which have for so long been grounded in our understanding of analog photography? And with that said, exactly what are the cultural implications of these new perceptual understandings for how audiences have now

[3] Gabriel Giralt, "Realism and Realistic Representation in the Digital Age," *Journal of Film and Video*, 62, no. 3 (2010): 3-16, 15.
[4] Roger B. Wyatt, "The Emergence of Digital Cinema," *Computers and the Humanities* 33, no. 4 (1999): 365-381, 365-366, 370-371.

come to consume and inhabit new outlets of virtual realities; whether fantastical digital characters, computer-generated landscapes, or vast stereoscopic realms?

It is only when we attempt to examine these new digital technologies and the virtual realities that they so often produce, that we can better understand the changing modes of perception and the cultural ramifications that have emerged as a result of the digital turn in cinema. To this end, I want to suggest that we now reside in a culture of digital immersion. More so than photographic film, digital cinema currently allows the viewer to inhabit and interact with cinematic realities in unprecedented ways, and it is this contemporary paradigmatic shift from the analog to the digital that has catalyzed fundamentally *new ways of looking* at the filmic image. This paper will essentially probe the uncharted territories surrounding these immersive, digital technologies and the virtual environments they generate. In particular, I will be focusing on the transforming perceptual practices and broader social effects that coincide with these innovative, digitally-mediated modes of cinematic representation.

In the first section of this paper, I will use James Cameron's *Avatar* as a model for understanding how spectators currently perceive advanced CGI rendering, and how this modern perception differs from our understanding of photographic realism. To drive home this point, I will be applying Stephen Prince's concept of perceptual realism to *Avatar's* virtual environs in order to demonstrate that the film's digitally-constructed reality is perceived through the ways in which its alien landscapes and creatures provide visual correspondences to the spectator's own reality. Expanding on this perceptual realism, I will suggest that *Avatar* is developing profound social consequences for viewers, particularly through its immense hyper-spectacularity. In this sense, we can

think of *Avatar* in terms of cultural theorist Jean Baudrillard's concept of the simulacrum; its fictionalized reality resembles a living, breathing world that once inhabited by the spectator, has the ability to usurp the position of the real.

In the next section, I will be focusing on motion capture technology as a form of "emotional immersion," using contemporary films like Rupert Wyatt's *Rise of the Planet of the Apes* (2011) to describe the way in which viewers now perceive the virtual body as an emotionally significant, filmic character. We can ultimately understand motion capture as a digital technology that exhibits a hybrid representational status through the combination of an on-screen, computer-generated body and the recorded movement of a live actor covered in sensor points that this on-screen image symbolizes. Because the realism inherent to the motion-captured body is grounded in the indexical motions of the live actor, we are able to experience vicariously the emotions of the virtual body in a manner similar to that of the photographically recorded actor. Using a model of realism established by Giralt and philosopher Jose Ortega y Gasset, I will show that motion capture signifies a surface realism that the spectator identifies with through accurate, perceptual cues from the digital body on screen. Yet on a deeper level of realism based primarily on notions of empathy, I will also suggest that the viewer is emotionally attracted to the virtual character the director has created by capturing the emotions of the actor's performance in reality.

In the final section of this paper, I will broaden the scope of my discussion on CGI and motion capture to include digital 3D technology in the context of the most recent stereoscopic revolution that has emerged in the past several years. Examining 3D films like *Avatar* (2009) and Martin Scorsese's *Hugo* (2011), I will suggest that

stereoscopic cinema is currently in a transition toward an aesthetic of immersion, where depth is used to present the stereoscopic image with a type of visual totality; no longer is the viewer forced to focus on the singular 3D object that ostensibly penetrates the theater space, but now perceives digital 3D as a production component- much like sound or cinematography- that is inseparable from the framework of the visual story on screen. This new aesthetic that has been adopted by a number of contemporary directors, is due largely to advances in 3D display technology and digital 3D camera systems that now provide a more stable and precise 3D picture than that of previous analog formats. I will also suggest that digital 3D can be thought of as a type of transcendent, virtual technology perceived through what I will call a visual-haptic response in which the viewer is presented with an image that comingles the senses of touch and sight to a point of dissociating with the materiality of the body and integrating into the technological, digital whole of the stereoscopic picture. Finally, I will be repacking Jean Baudrillard's concept of the simulacrum as a virtual reality not necessarily dystopian in scope, but rather in the context of the digital 3D documentary, can be thought of as a precise facsimile of the objectively real that exposes the viewer to new ways of seeing that might otherwise be inaccessible in reality.

Chapter Two: A Brave [Blue] World: Seductive CGI and Perceptual Realism in *Avatar*

To the casual movie audience, the most familiar of the digital technologies to emerge in the last several decades is undoubtedly the use of computer-generated imagery (CGI) in the creation of special effects. From James Cameron's metamorphic cyborg villain in *The Terminator 2* (1991) and its ability to shape-shift into other figures, to the CGI-modeled Art Deco cityscapes of Kerry Conran's *Sky Captain and the World of Tomorrow* (2004), directors have presented audiences with virtual, filmic realties that are fundamentally distinct from the photographic realism of earlier cinema.

In *Avatar*, with its reliance on motion capture camera systems and state-of-the-art CGI rendering, Cameron was able to create the virtual world of Pandora; an alien moon complete with bioluminescent jungles, vicious monsters, as well as the ten-foot-tall, blue Na'vi- the planet's indigenous alien race. Cameron fully imagined the Na'vi and some of Pandora's other alien life by capturing the motions of live actors using virtual camera systems that allowed the director to film the actors' virtual manifestations along with digital environments in real time.

Because these computer-generated effects in *Avatar* are in fact so groundbreaking, viewer perception of such digital technologies has yet to be fully realized in regards to film theory, specifically for notions of photographically-coded cinema. As I have already proposed, the CG world of Cameron's *Avatar* is not grounded in photographic realism, and thus movie-goers must make perceptual judgments regarding the apparent reality of the film's fictional environments and creatures. The Na'vi and their home planet of Pandora allude to reality through a cinematic language

that conforms to the concept of 'perceptual realism' proposed by Prince, in which the spectator understands CGI through the ways certain perceptual cues programmed into the film's represented reality might match up to their real-world, visual experience. Nonetheless, it is important to think of *Avatar* as a type of two-edged sword; a film that is undoubtedly revolutionary in its digital technology, yet exhibits a hyper-realistic simulation removed from that of photographic realism that is perceived by the spectator as an allusion to the real. It is this perceptual familiarity that makes Cameron's spectacle all the more enticing to consume.

The immediate challenge posed by computer-generated representation is the creation of images that appear to have a photographic likeness from things which are essentially non-photographable. Film theory has traditionally framed cinematic realism as that which is inextricably connected to the photographic image; particularly the photograph as an object linked existentially to its corresponding referent in reality. As Roland Barthes has argued in *Camera Lucida: Reflections on Photography*, unlike a drawing or painting, a photograph always adheres to the object it is referencing and thus can never be separated from it:[5]

> It is as if the Photograph always carries its referent with itself, both affected by the same amorous and funereal immobility, at the very heart of the moving world: they are glued together, limb by limb, like the condemned man and corpse in certain tortures; or even like those pairs of fish which navigate in convoy, as though united by an eternal coitus.[6]

Barthes further claims that by taking a picture of an object with a camera, one is unmistakably capturing the "necessarily real thing placed before the lens without which

[5] Roland Barthes, *Camera Lucida: Reflections on Photography*, New York: Hill and Wang, 1980, 5.
[6] Ibid., 6

there would be no photograph."[7] In Barthes' terms, the photograph affirms the existence of its representative object, or as Barthes aptly states, "[e]very photograph is a certificate of presence."[8]

As Andre Bazin has observed regarding cinematic realism, the photographic sign functions much like that of a fingerprint; it leaves a mechanical residue or a "decal of transfer" of the objects it represents.[9] Bazin states in his seminal essay "The Ontology of the Photographic Image" that:

> The photographic image is the object itself, the object freed from the conditions of time and space which govern it. No matter how fuzzy, distorted, or discolored, no matter how lacking in documentary value the image may be, it shares, by virtue of the very process of its becoming, the being of the model of which it is the reproduction: it is the model."[10]

By observing a photographic still from Ridley Scott's *Alien* (1979), a film produced largely before the onset of advanced CGI technology, one can certainly witness Barthes' and Bazin's notions of the photograph in relation to cinema (Figure 2.1).[11] In the still, Brett (Harry Dean Stanton) is massacred by the Alien within the bowels of the commercial towing spaceship *Nostromo*. Although a fictional representation, the still functions as an indexical symbol; it bears an existential relationship to its referred objects, but arguably the real objects recorded in front of the video camera- Harry Dean

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[7] Ibid., 76
[8] Ibid., 5-6, 87
[9] Andre Bazin, "The Ontology of the Photographic Image," *Film Quarterly*, 13, no. 4 (1960): 4-9, 8.
[10] Ibid.
[11] I use Ridley Scott's *Alien* in this example because it represents a fantastical, cinematic reality that has been constructed by set designer H.R. Giger, who within the film, created the Alien, the set design for "The Derelict," as well as for the "Space Jockey." Giger's set designs provide a good point of comparison to computer-generated films because they present the viewer with a cinematic reality that is meant to be photographed by the camera, in opposition to creating an alien monster and spacecrafts via computer software. I would also like to mention that although *Alien* was produced before an exponential growth in the use of CGI in cinema, particularly in the 1980s with film's like *Tron* (1982), *The Last Starfighter* (1984), *Young Sherlock Holmes* (1985), and *The Abyss* (1989), *Alien* did employ computer-generated, wire frame models on some of the navigation monitors during the film's primary landing sequence.

Stanton, actor Bolaji Badejo wearing H.R. Giger's ingeniously designed alien costume, as well as the *Nostromo* set design with its recycled scrap metal props.

This same film still attests to the fact that these filmic objects; Stanton, alien costume, and the mise-en-scène of the *Nostromo*, once existed before the camera lens and thus were captured onto a reel of film. In Bazin's terms, the image arguably operates as a remnant of the filmic objects (Stanton, costume, and movie set) that once existed in front of the camera. Although the still is characteristic of the illusory nature of cinema in its attempt to render a fictional representation of an alien attack, it is still the residual footprint of the actual, existing entities projected into a screen; a model of the real witnessed before the spectator.

Film theorists have adopted elements of realism tied to the referential quality of the photograph because film has been traditionally defined as a photographic medium; we can think of the motion picture as essentially a series of photographic images shown in rapid secession via a projector to create the illusion of movement. Yet computer-generated imagery has in many regards leveled predetermined notions of photographic realism established by Barthes and Bazin. As Stacey Abbott suggests, computer-generated images do not always rely on a pro-filmic reference; the digital creation of a vicious alien creature or nuclear explosion can be symbols that have no material connection to the objects they seek to represent, and thus CGI often appears in opposition to the indexical nature of the photograph.[12]

[12] Stacey Abbott, "Final Frontiers: Computer-Generated Imagery and the Science Fiction Film," *Technoculture and Science Fiction* 33, no. 1 (2006): 89-108, 98.

But as Philip Rosen indicates, computer-generated imagery is often rooted in an indexical origin by portraying, manipulating, and borrowing from images that bear an indexical relationship.[13] In *Avatar*, live actors in motion capture attire were digitally reproduced via virtual camera systems only to be further tweaked and transformed into aliens once the digital information was inscribed into the computer and presented as such. In this sense, I think it is appropriate to suggest that CGI can be based in indexicality but is transformable to a seemingly limitless degree; computer-generated images may originate through digital technologies that prescribe to a photographic language, but they can always be metamorphosed into more pronounced digital forms by way of computer software.

In ways that are obvious, the ability to continually manipulate digital imagery allows it to depart considerably from notions of photographic reality. In Steven Spielberg's *Minority Report* (2002), a group of computer-generated spider robots track down fugitive John Anderton (Tom Cruise), and try to scan his retinas for ID verification while he hides in an ice-filled bath tub in an effort to avoid the robots' body heat sensors (Figure 2.2). In the scene, the metallic spiders scuttle hurriedly across an apartment floor, and attempt to prod Anderton out of the tub, electrocuting his body with a charge emitted from their legs.

The obvious paradox lies in the fact that these spider robots are not derived from any sort of pro-filmic reference, yet appear photographically real in their physicality, surface texture, and a number of other realistic elements programmed by the

[13] Philip Rosen. *Change Mummified: Cinema, Historicity, Theory*. Minneapolis: University of Minnesota Press, 2001, 314.

computer. But it is arguably the animator's ability to render realistic lighting, a metallic sheen on the spiders' bodies, as well as their crustacean-like motions that register to the common movie-goer as photographically viable through these computerized, perceptual indications. Thus one of the many mystiques of CGI is its ability to ground something as bizarre as a robotic arthropod in a seemingly photographic reality through the use of computer software. As Roger Wyatt has observed in regards to the ambivalent nature of the computer-generated image:

> In Digital Cinema images are taken from life and reworked into another image of reality that is often surrealistically interdisciplinary in nature. These images occupy a conceptual zone somewhere between videography and animation. A watermelon with a gold hole drilled in it would be an example of this kind of image. Reality becomes extended by abstraction into visions of reality. The use of software tools has much to do with why these images are as they are.[14]

The animator of the computer-generated image can essentially mimic the indexical nature of the photograph by borrowing from world-based elements and toying with them by way of computer software so as to appeal to the viewer's perceptual cognition of digitally-rendered lighting, texture, and movement. But as Wyatt indicates, this also happens because the computer-generated image extracts actual objects from the spectator's reality- in this particular example spiders and machines- and processes them into something that although is referentially fictional, appears photographically realistic before our very eyes.

As a concept writer-director James Cameron developed continually for almost 15 years, *Avatar* has arguably propelled digital filmmaking into a brave new dimension by immersing viewers into the digitally-constructed environment of Pandora (Figure 2.3). In the film, paraplegic soldier Jake Sully (Sam Worthington) is given a chance to inhabit a

[14] Wyatt, "The Emergence of Digital Cinema," 371.

humanoid body of the Na'vi race through a genetically-engineered matching process between human and alien DNA. The Na'vi avatar that Sully embodies represents a group of bipedal, cat-like aliens that reside on the lush moon of Pandora, which has become increasingly encroached upon by a human colony attempting to mine its precious mineral Unobtanium. Because humans cannot breathe the air on Pandora, they must use Na'vian/human hybrid bodies to explore and infiltrate the moon's biosphere. Through the use of his avatar, Jake experiences a world with giant waterfalls, floating islands, jungles, and a plethora of diverse alien life as he attempts to gain acceptance into Na'vian society. Cameron's *Avatar* seamlessly mixes live actors and footage with computer-generated technologies that can capture the physicality and facial expressions of an actor through specialized, virtual camera systems. These virtual camera systems were able to project the computer-generated representation of the film's actors interfacing with the virtual Pandora in real time. It is these digital technologies used in *Avatar* that bring into question the very nature of spectatorial experience, especially for a film that takes the creation of digital imagery to new and exceptional heights.

As a far leap from the photographic realism of earlier cinema, *Avatar* manipulates the spectator's visual familiarity with reality through perceptual correspondences created by the visual effects personnel at Weta Digital. Viewer comprehension of Pandora and its creatures can be largely attributed to Cameron's virtual performance capture stage, otherwise known as "the volume." Cameron's brainchild, the volume stage resembles a large warehouse space approximately 120 ft. by 80 ft. with a center area that scans the motions of actors using approximately 120 to 130 digital cameras. Within fractions of a second, the data captured from the cameras is transmogrified into computer-generated

"avatars" of the live actors performing on the surface of the staging area (Figure 2.4). Through the use of a software program called MotionBuilder, animators at Weta Digital could then insert actors into the virtual jungles of Pandora; a technological breakthrough that allows for the viewer to experience *Avatar* through direct perceptual allusions to reality.[15]

In a specific scene filmed within the confines of the volume stage, actress Zoe Saldana, who plays Na'vian princess Neytiri in the film, leaps on to the back of a flying animal called a Banshee. As Cameron states, "Believe it or not, [Saldana] was actually jumping onto the back of a really big stunt guy- like a 280-pound linebacker stunt guy…The object there was to have her land onto an organically moving platform…And he actually had the riding tack on with stirrups and everything."[16] The digital manifestation of the Banshee creature is an image that for obvious reasons has no categorical reference beyond the fictional realm of Cameron's film. But as Stephen Prince argues, unreal images can certainly be understood as perceptually realistic in the way that inscriptions of realism are read by the viewer in relation to perceptual correspondences embedded in the digitally-constructed film. Prince further suggests that, "[i]nstead of asking whether a film is realistic or formalistic, we can ask about the kinds of linkages that connect the represented fictionalized reality of a given film to the visual and social coordinates of our own-three dimensional world…"[17]

In Prince's terms, the viewer comprehends the Banshee creature not as something that possesses photographic indexicality, but rather as an object understood through

[15] Melissa Block, Robert Seigel, "James Cameron, A King With A Soft Touch?" 12/18/2009.http://www.npr.org/templates/story/story.php?storyId=121604325 (accessed 3/08/2011).
[16] James Cameron quoted in Melissa Block, Robert Seigel, "James Cameron, A King With A Soft Touch?"
[17] Prince, "True Lies: Perceptual Realism, Digital Images, and Film Theory," 32.

perceived correlations to the spectator's reality. Because the Banshee's motions have been appropriated from an organic model (a hulking stunt double), the creature is arguably perceived as referencing an amalgam of animals witnessed in the viewer's world. And it is these motions programmed by animators that allow the viewer to interpret the fictional Banshee as something that appears photographically credible.

Similar to the actions of an untamed horse, the Banshee appears as a skittish creature to unfamiliar riders, particularly evident when a naive Jake attempts to create a bond with the Banshee through a ritual practice of physical/neural connectivity, allowing for creature and rider to fly as a unified organism through the skies. As a fictional creature, we might easily perceive the Banshee as photographically realistic through both its reptilian facial expressions and bat-like aeronautical maneuvers (Figure 2.5). Nevertheless, this form of motion capture that allows for the Banshee to appear photographic, demonstrates the limitless manipulation of CGI; the technology can borrow from the motions of an object extracted from the real world, such as a hulking stuntman, and transform them into an animal that is referentially non-existent.

When a helpless Jake is pursued through Pandora's thick underbrush by a vicious, predatory creature known as the Thanator, the viewer once again witnesses perceptual cues developed by the animation team at Weta Digital. Within the scene, Jake hurdles over logs and tree roots in order to escape from the clutches of the Thanator's jaw. Jake then slides underneath the root system of a large tree while the creature attempts to snap and dig its way toward him. Rigged with a specialized motion capture suit designed for maximum mobility, Worthington executed these escape maneuvers on the floor of the volume stage only to be later planted within a virtual jungle environment by Weta

Digital, giving the illusion of an actual chase along the floor of a rainforest. The Thanator, with its pronounced muscular frame, moves similar to that of a wolf or a large feline like a panther. We might easily think of the creature's motions as having been programmed to appeal to the viewer's perceptual understanding of a feral canine cornering its prey, which becomes all the more evident when the Thanator rips and tears at Jake, snapping wildly at his body through the tree roots.

When the creature picks Jake up by his back pack and proceeds to shake him violently back and forth, the viewer arguably interprets such motions in terms of a wolf instinctually attempting to snap the neck of its game, or on a basic level, a dog shaking around a chew toy clutched in its mouth. Even the protracted jumps and bounds of the creature have been manipulated by the computer so as to mimic the characteristics of a jungle cat in pursuit of a smaller animal (Figure 2.6). In these ways, Cameron's animation team can make such fictional creatures appear photographically realistic by engendering them with the motions of animals the viewer has witnessed in the everyday.

The perceptual realism inherent to *Avatar* can also be witnessed in the facial expressions of actors captured on the volume stage. While performing on the stage, Saldana and others were equipped with a helmet and small lipstick camera used for recording the subtle motions of facial muscles, pupil contraction, as well as the interactions between teeth, lips, and tongue. To plot the facial patterns, make-up artists marked green dots on the actors' faces using a form-fitting mask. The lipstick camera could then capture each minute facial motion based on the individual dot pattern. By utilizing a program created by Weta team member Jeff Unay, the motions captured from

actors' faces could then be matched to their corresponding CG counterparts, allowing animators to lip sync actors to their Na'vi characters while retaining their individual, facial mannerisms, which were then transferred to each actor's computer-generated portrayal (Figure 2.7). [18] The computer-generated facial gestures of Saldana as a ten-foot-tall Na'vian princess are largely based on a visual comprehension grounded in the spectator's understanding of the natural world; Saldana and the film's other actors appear photographically real in the way viewers perceive such facial attributes as those characteristic to a human being and not the referentially fictional Na'vi.

In part, this perceptual understanding of *Avatar* functions through the actual motions of actors captured on the volume stage, but it is also the manner in which Weta Digital was able to animate these captured live performances as well as Pandora's flora and fauna that facilitates viewer cognizance of the film. Animators used the 3D software ZBrush and Autodesk Maya to breathe life into the Na'vi aliens and the planet's 10 or so other terrestrial creatures, providing realistic motions for their various body parts. According to the film's animation director Andy Jones, his team would "whip [Na'vi] tails around if they were upset, and use them as a counterbalance when they ran…They were like another appendage. We also found the ears really useful for adding emotion to the character. The ears tell when a Na'vi is angry or shocked just as they do for cats and dogs."[19] For the 3D model of the Banshee creature, Weta Digital animated its body to match the characteristics of a horse or any number of large quadruped by having its legs transition to different gaits. Because a majority of *Avatar's* land creatures were designed to include six legs, Jones and his team simply performed creature motion using only four

[18]Barbara Robertson, "CG in Another World," *Computer Graphics World* 32, no. 12 (2009): 12-20, 4.
[19] Andy Jones quoted in Barbara Robertson, "CG in Another World," 5.

legs and then added in the remaining appendages once quadrupedal movement was deemed realistic. In scenes that featured Direhorses- gargantuan horse-like creatures with extended necks and six legs- the Weta team performed such animals to gallop and trot while mounted with Na'vian warriors in an effort to mirror the motions of an actual horse carrying the extra weight of its rider.

In another scene, a pack of animals known as Viperwolves, hunt Jake Sully after he becomes lost in the nightfall of Pandora's rainforest. Weta team members performed this particular grouping of creatures to resemble the characteristics of a voracious wolf pack searching for food. These six-legged animals were portrayed by animators to match the quirks of a canine hunting party moving swiftly in unison and cooperating with one another through actions such as paw movement, facial tics, and audio cues.[20] The digitally-rendered images of the Viperwolf pack indicate the interspecific nature of CGI in its ability to meld two animals as vastly disparate as a canine and snake into a singular organism. Weta animators show the Viperwolves as fluently exhibiting the mannerisms of both animals; not only do the creatures navigate in a small communicative group, but they feature an array of tentacles on their heads and strike at prey in a serpentine fashion.

Nevertheless, it is the way in which Cameron's animators have created the film's CG creatures around perceptual cues related to real animals that allows for viewer understanding of the film. The Na'vi appear photographically realistic because of the visual symbols presented to the viewer; their alien body language is highly reminiscent of a characteristic feline. In a similar vein, the nature of the Direhorse replicates the motions

[20] Pandorapedia: The Official Field Guide. "Viperwolf." http://www.pandorapedia.com/viperwolf (accessed 04/25/2011).

of a galloping steed, just as the Viperwolves correspond to the mannerisms of a wolf pack hunting its prey. It is these motions programmed by animators that allow the fictional, computer-generated creatures in *Avatar* to appear photographic in the eyes of the viewer.

The computer-generated surface textures of the Pandoran ecosystem also play a significant role in viewer perception of the film. Weta team members painstakingly rendered Pandora's digital landscape so as to present audiences with a highly-nuanced, photorealistic reality. Animators considered every minute surface detail when creating the planet, generating appropriate ripples and currents for bodies of water, as well as taking into account wind effect on surrounding flora and fauna. During a conference meeting with Weta artists, Cameron commented on the CG image of a Pandoran stone arch by stating:

> I hate this fucking thing, but I can be very specific about it…This looks like petrified wood…It has longitudinal grain structure. It looks very fragile to me. This hard, crystally [sic] structure looks like *barn* wood. We want to say that this arch formed as igneous rock, that it's a lava formation that got eroded, but it's fracturing out along the crystal planes of minerals.[21]

Demonstrated by Cameron's thorough analysis, Weta Digital ultimately took great strides to animate the film's environments based on sensory indications of planet earth's natural landscape. Although such a Na'vian stone monument is essentially non-photographable as it has no corresponding referent in reality, it has been conceived by animators to mirror the attributes of a rock observed in the viewer's everyday existence. Because the viewer ultimately subscribes to these perceptual cues worked into Pandora's digital

[21] James Cameron quoted in Dana Goodyear, "Man of Extremes: The Return of James Cameron," 10/26/2009.http://www.newyorker.com/reporting/2009/10/26/091026fa_fact_goodyear (accessed 03/16/2011).

environments, it becomes possible to interpret a Na'vian stone arch as an object that exhibits a photographic likeness to an actual igneous rock.

The textured CG surfaces of Pandora's creatures function in a similar way. During the same staff meeting, Cameron also commented on a CG image of a Banshee's snarling jaw by stating:

> Look at the gill-like membrane on the side of the mouth, its transmission of light, all the secondary color saturation on the tongue, and that maxilla bone. I love what you did with the translucence on the teeth, and the way the quadrate bone racks the teeth forward. It's a sharky [sic] thing. As wacky as this creature is, it looks completely real…The banshee lives! He's a fierce-looking sonuvabitch [sic].[22]

The nature of vocabulary Cameron uses to describe *Avatar's* creatures further implicates Weta Digital's effort to imbue the film's fictional animals with the physiological makeup of organisms movie-goers have witnessed in the flesh. Animators modeled the Banshee's organic frame after the skeletal anatomy common to most Sauropsida- the animal group composed of all existing reptiles, birds, as well as their direct antecedent, the dinosaur- evident in Weta Digital's use of a prominent quadrate bone on the CG model. But it is arguable that animators also borrowed traits common to select amphibians, with the rendering of a "gill-like membrane." Going a step further, the Weta team then filled in added details of the creature's face such as roughness of the skin, using both bone and membrane structure as a template. These zoologically-grounded cues influence audiences to interpret the Banshee in a photographically realistic manner, and by modeling the creature's surface appearance after a facial structure common to birds, reptiles, and

[22] Ibid.

amphibians, animators have attempted to manipulate the spectator's real-world, visual understanding of how these creatures appear on a superficial level.

One of the biggest challenges for Weta Digital was rendering the Na'vi aliens' blue skin color so as to appear organic and not like several layers of blue paint had been applied to their bodies. According to senior visual effects supervisor Joe Letteri, the Na'vi "needed to have warmth under their skin, so we had to find the right shades of blue and blood color that would look good in firelight, blazing sun, overcast skies, and rain. Blue skin quickly wants to look like plastic."[23] To keep Na'vi skin from looking artificial and "painted on," Weta Digital took photographs under controlled lighting of adolescents with seemingly flawless skin. Because even these individuals exhibited imperfections on their skin's surface- spots, bumps, blemishes, and discoloration- animators could then incorporate such flaws into the CG texture mapping of Na'vian skin, and even fabricate a layer of pores on each alien's epidermis (Figure 2.8). These textural clues actualized by the Weta team facilitate the creation of a spectatorship grounded in perceptual realism; the Na'vi appear photographic due to the human-like qualities of their skin.

Lighting up the jungles of Pandora was certainly taken into consideration by animators when structuring *Avatar's* computer-generated reality. In a memorable scene, Jake and Neytiri take a nighttime stroll through the Pandoran rainforest, surrounded by flora and fauna that glistens with a bioluminescent quality. Large jellyfish-like creatures glow with a brilliant magenta as they float up toward the forest canopy (Figure 1.9), while small, illuminated creatures resembling dinoflagellate surround Jake and attempt to

[23] Joe Letteri quoted in Barbara Robertson, "CG in Another World," 6.

heal his freshly-received wounds. Beyond Jake and Neytiri, the jungle radiates a phantasmagoria of light and color patterns from a variety of fictional organisms.

To create such an effect, digital artists used a technique known as subsurface scattering to give plants and animals the appearance of a candle-like glow, as well as a method known as spherical harmonics to create simultaneous patterns of light within scenes. With spherical harmonics, a technique commonly used in interactive gaming, animators assigned a geometric lighting angle to individual computer-generated plants and then applied a singular light source to the scene. Based on its own stored calculation, each organism was then able to emit a specific amount of illumination in correlation with its individual characteristics, meaning that the Weta team could essentially light the entire Pandoran rainforest using a singular, computer-generated light source.[24] Regarding the nature of computer graphics and light, Margaret Hagen and Glenn Bresnahan have pointed out that "[i]n order for a representational picture to be effective perceptually, it presumably must contain visual information for objects and events similar to that found in the ordinary environment…[T]he surface of the picture must structure the light to the eye in a manner equivalent to the structured light from ordinary world surfaces.[25]

When programming scenes that featured a plethora of bioluminescent life, the film's animators arguably structured light patterns to match those that appear deep below the ocean. Borrowed from visual experiences in reality, the lighting of Pandora's jungles was heavily influenced by Cameron's passion for scuba diving and subaquatic organisms. As Letteri has stated, "The planet [Pandora] was really inspired by [Cameron's]

[24] Spherical harmonics effect as explained by visual effects supervisor Eric Saindon in Barbara Robertson, "CG in Another World," 7.
[25] Margeret A. Hagen, Glenn J. Bresnahan, "Computer Graphics and Visual Perception: The State of the Art," *Visual Arts Research* 10, no. 1(19) (1984): 32-41, 32.

underwater dives…There's bioluminescence. The creatures have blue skin and the animals have vivid patterns. We all know the rules: Big animals don't have vivid colors. But, they do underwater, and [James] said they can exist on this planet. So we brought that color palette to the surface and made it believable…"[26]

These lighting effects created by Weta Digital take advantage of the spectator's ability to register sensory cues appropriated from real environments on earth. The incandescence of Pandora's bizarre, forest organisms alludes to notions of lighting (and movement) that one might have witnessed, whether through a television program or in actuality, from organisms that produce their own light via chemical, bodily reactions. In part, *Avatar's* animators have mimicked the peculiar, glowing creatures present in the Mesopelagic and Bathypelagic zones of the ocean- areas so deep, that sunlight no longer penetrates and thus organisms generate their own light. But in particular scenes, animators have also appropriated elements of lighting from terrestrial organisms such as bioluminescent fungi to reinforce viewer perception of the film.

Cameron's *Avatar* and its unique ability to manipulate the spectator's sensory understanding of reality, has also produced considerable social ramifications for movie audiences. In obvious ways, *Avatar* relies heavily on the spectacle of CGI to draw in big crowds. The enthusiastic response to the spectacular realm of Viperwolves and bioluminescent forests suggests that Hollywood is not only capable of producing computer-generated worlds that appear nearly photographic, but anticipates a fan base that demands them and is eager to consume them.

[26]Joe Letteri quoted in Barbara Robertson, "CG in Another World," 2.

For many viewers, the immersive nature of *Avatar* has made reality appear insignificant and dull in comparison. Several months after the film's release, internet fan sites were flooded with viewers experiencing symptoms of post-*Avatar* depression; feelings of utter gloom and sadness after watching the film and realizing how incredibly boring real life is compared to the beatific world of Pandora. On the website "Avatar Forums," over 1,000 individuals responded to a topic thread titled "Ways to cope with the depression of the dream of Pandora being intangible," in an attempt to come to terms with the film's fictional status. One forum member known as Elequin expressed his obsession with *Avatar* by stating:

> That's all I have been doing as of late, searching the Internet for more info about "Avatar." I guess that helps. It's so hard I can't force myself to think that it's just a movie, and to get over it, that living like the Na'vi will never happen. I think I need a rebound movie…" [27]

Thread responses on the fan site "Naviblue" were considerably more dismal. A forum member by the name of "Mike" confessed that he wrestled with suicidal thoughts after watching *Avatar* and realizing that the virtual reality of Pandora was inaccessible:

> Ever since I went to see 'Avatar' I have been depressed. Watching the wonderful world of Pandora and all the Na'vi made me want to be one of them. I can't stop thinking about all the things that happened in the film and all of the tears and shivers I got from it…I even contemplate suicide thinking that if I do it I will be rebirthed [sic] in a world similar to Pandora…"[28]

Internet super fans were not the only demographic to totally immerse themselves into the realm of Pandora, as many biologists were just as willing to admit to the gratification they received from watching the film. Biologist and writer Carol Kaesuk Yoon

[27] Elequin quoted in Joe Piazza,"Audiences experience 'Avatar' blues," 01/11/2010.http://articles.cnn.com/2010-01-11/entertainment/avatar.movie.blues_1_pandora-depressed-posts?_s=PM:SHOWBIZ (accessed 04/26/2011).
[28] Mike quoted in Joe Piazza, "Audiences experience 'Avatar' blues."

exclaimed in a *New York Times* article that watching *Avatar* channeled the same feelings of excitement and discovery that a scientist gets from observing the natural world. According to Yoon:

> …[I]t is time for all the biologists who have not yet done so to shut their laptops and run from their laboratories directly to the movie theaters, put on 3-D glasses and watch the film "Avatar."…Cameron's otherworldly tale…has somehow managed to do what no other film has done. It has recreated what is the heart of biology: the naked, heart-stopping wonder of really seeing the living world...With each glance, [biologists] are reminded of organisms we already know, while marveling over the new…It is a mental tickle, and wonderful confusion sparks the thought, "Oh, that looks like a horse, but wait, it has six legs and it's blue, and whoa, that looks like a jellyfish but it's floating in the air and glowing.""[29]

As fan sites and Yoon's article suggest, the hyper-spectacularity of *Avatar* and its spectatorship as a perceptually realistic film, has ushered in a level of blockbuster consumption where audiences do not just simply pay for a movie ticket, but attempt to physically and mentally inhabit computer-generated dreamscapes long after the pixels of the digital projector have ceased to dance across the screen (Figure 2.10).

Because the CGI technologies and spectatorship of Cameron's *Avatar* present such new and innovative concepts within the realm of cinema, it would seem that the proper terminology for describing the film as a social phenomenon has yet to be fully realized or moreover, framed by film and new media scholarship. One such way *Avatar* can be thought of as a social phenomenon is in terms of the megaspectacle, a concept formulated by Steven Best and Douglas Kellner as an elaboration of Guy Debord's theory of the spectacle and social consumption. Debord suggests in *The Society of the Spectacle*, that the idea of the spectacle is inextricably tied to the passive consumption of

[29] Carol Kaesuk Yoon, "Luminous 3-D Jungle Is a Biologist's Dream," 01/19/2010.http://www.nytimes.com/2010/01/19/science/19essay.html (accessed 04/26/2011).

mass media by society, and through such patterns of consumption, capitalistic societies create separation between laborers and their active modes of production.[30] Borrowing from Debord, it would seem that the passive consumption and willingness to inhabit the cinematic reality of *Avatar* can certainly be framed in terms of Best's and Kellner's reference to the megaspectacle:

> Megaspectacles…involve a significant escalation of spectacle in size, range and intensity. They range from superhyped films like Star Wars (with its high-powered sound and special effects) to theme parks that create intense and thrilling technologically-mediated experience to media-generated passion plays like the OJ Simpson trial or the Clinton sex scandal, which produce such saturation coverage that they define an era of culture.[31]

Considering Best's and Kellner's description, *Avatar* and its ability to successfully manipulate the viewer's perceptual understanding of reality, functions as a megaspectacle through its promotion of hyper-consumerism and Debordian notions of separation. By presenting a computer-generated fantasy realm that for many consumers adopts the position of the real, *Avatar* possesses the ability to disengage viewers from actual notions of reality through the allurement of CGI. In this way, the world of Pandora portrays a reality of pleasure and exhilaration that for many viewers once consumed, leaves the real world to function as a trivial byproduct.

In further exploration of Cameron's film, *Avatar* undoubtedly appears as a simulacrum of the real. In his treatise *Simulacra and Simulation*, cultural theorist Jean Baudrillard argues that within recent times, the mass propagation of images, hyper-commoditization, and innovations in visual technology have fostered the development of

[30] Guy, Debord, *The Society of the Spectacle,* London: Rebel Press, 1983, 13-14.
[31] Steven Best, Douglas Kellner, "Debord, Cybersituations, and the Interactive Spectacle," *SubStance* 28, no. 3 (1999): 129-156, 133.

a new stage of the simulacrum in many facets of modern society.[32] As Baudrillard further argues, the most recent stage of the simulacrum describes a simulation of reality in which society has taken to be the real and fails to recognize the original referent as reality.[33] As an example, Baudrillard recounts a story by Jorge Luis Borges in which cartographers create a map that physically covers the area of an entire empire, existing in a perfect ratio with the landscape underneath it. The map functions as an exact copy of the imperial territory. When the map begins to wither away with time, the citizens of the empire, who have long understood the map to be reality, are saddened by its decay. Underneath the map lies the original empire which has withered into a desert. To Baudrillard, the tattered map has usurped the position of the desert itself; functioning as a simulacrum of the real.[34] Similar to the map in Borges' tale, we might think of *Avatar* as a film that functions in a manner closely related to that of Baudrillard's simulacrum. The computer-generated world of Pandora, with its incandescent jungles and blue Na'vi, provides a simulation of the living world that for many fans has the ability to supplant the position of reality. In this sense, *Avatar* is a projection of the hyperreal; the film constitutes a represented reality derived from virtual elements that have no existence in real life. Although it is arguable that the advanced CGI used in *Avatar* has yet to reach a point of technological advancement where the average viewer fails to discern the film from reality, it does indicate a somewhat disturbing trend in the presentation and subsequent consumption of virtual worlds.

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[32]Jean Baudrillard, "Precession of Simulacra," *Simulacra and Simulation*, trans. Sheila Faria Glaser (University of Michigan Press, 1994), 2-3, 6.
[33] Ibid.
[34] Baudrillard, "Precession of Simulacra," 1-2.

In Kathryn Bigelow's dystopian sci-fi thriller *Strange Days* (1995), individuals can tap into virtual realities through the use of a technological apparatus called a SQUID or Superconducting Quantam Interface Device. By directly accessing the cerebral cortex, the SQUID allows a viewer to experience human memories through all five senses as if they were actually present at the scene of the event. Through black-market trading, viewers can obtain and experience any reality they desire via a SQUID; oftentimes completely abandoning reality to fully engage in the pre-recorded simulacra the device has to offer. Although by no means as immersive an experience as the virtual worlds in *Strange Days*, *Avatar* and its perceptually realistic CGI, are perhaps the beginning of a new breed of virtual hyper-facsimiles through which their consumption, viewers begin to substitute computer-generated simulacrum for the actual thing.

As media theorist Marshall McLuhan suggests in *Understanding Media: The Extensions of Man*, forms of media have their own grammatical structure and language by which to be observed and studied.[35] Conversely, *Avatar* and the computer-generated imagery inherent to the film represent a medium by which a proper grammar has yet to be entirely formed. In the grander scheme of film and media studies, the technology and spectatorship of Cameron's film are still such novel concepts that it is truly uncertain exactly what repercussions the seductive reality of Pandora currently has on our society. It is without question that the technological innovations used in *Avatar* appear as a new level of spectacle; a virtual reality that allows audiences to inhabit a more powerful and compelling form of interaction in which Banshees, Thanators, and bioluminescent night life, may be taken as something that is considerably more "real" than the outside world.

[35] McLuhan, Marshall. *Understanding Media: The Extensions of Man.* New York: New American Library, 1964, 27-30.

But what does this indicate for the future of megaspectacle interaction? Will the creation of computer-generated realities eventually influence audiences to believe they are interacting with a genuinely real environment rather than a projected simulation? Whether sexual fantasies, a tropical island vacation, or perhaps even a counter terrorist training exercise?

Avatar is in itself a highly ambiguous form of media that requires a different theoretical framework removed from that of traditional film theory in order to be fully understood as a cultural and cinematic phenomenon. Cameron's *Avatar* appears as a revolution in cinematic discourse, particularly in the spectatorship of fantastical computer-generated realities, but at a price as the film arguably achieves a new level of spectacle interaction that further seduces as well as isolates the consumer from the everyday.

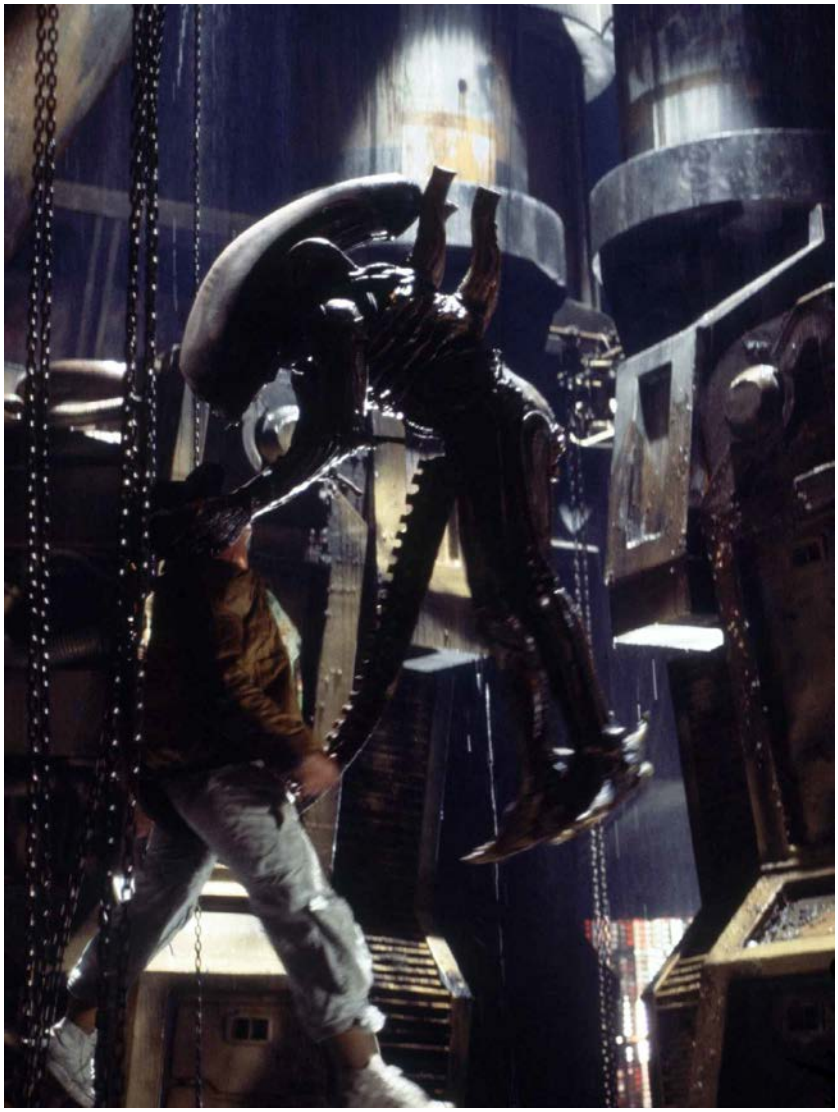

Figure 2.1. *Alien* (1979, Paramount HE). Brett is attacked by the Alien within the depths of the *Nostromo.* Courtesy of Paramount HE.

Figure 2.2. *Minority Report* (2002, Twentieth Century Fox Film Corporation). A troop of spider bots electrocute Anderton and attempt to scan his retinas. Courtesy of Twentieth Century Fox Film Corporation.

Figure 2.3. *Avatar* (2009, Twentieth Century Fox Film Corporation). The digitally-constructed biosphere of Pandora. Courtesy of Twentieth Century Fox Film Corporation.

Figure 2.4. *Avatar* (2009, Twentieth Century Fox Film Corporation). An actor performing on the volume stage with their virtual manifestation captured on the virtual camera display. Courtesy of Twentieth Century Fox Film Corporation.

Figure 2.5. *Avatar* (2009, Twentieth Century Fox Film Corporation). A reptilian Banshee creature grounded in the motions of an actor filmed within the volume stage. Courtesy of Twentieth Century Fox Film Corporation.

Figure 2.6. *Avatar* (2009, Twentieth Century Fox Film Corporation). The Thanator pouncing after Jake. Courtesy of Twentieth Century Fox Film Corporation.

Figure 2.7. *Avatar* (2009, Twentieth Century Fox Film Corporation). Zoe Saldana performing the role of Neytiri using motion capture facial cameras. Courtesy of Twentieth Century Fox Film Corporation.

Figure 2.8. *Avatar* (2009, Twentieth Century Fox Film Corporation). The detailed nuances of digitally-rendered Na'vian skin structure created by Weta Digital. Courtesy of Twentieth Century Fox Film Corporation.

Figure 2.9. *Avatar* (2009, Twentieth Century Fox Film Corporation). *Avatar's* bioluminescent nightlife created by Weta Digital using CG lighting software. Courtesy of Twentieth Century Fox Film Corporation.

Figure 2.10. An *Avatar* super-fan dressed as a Na'vian warrior. Courtesy of examiner.com.

Chapter Three: Capturing (E)motion: Motion Capture, Realism, and the Virtual Body

As I have touched on with the digital structuring of the Navi from *Avatar*, aside from the creation of nuanced computer-generated worlds, within the past 25 years films have increasingly employed CGI to depict fantastical, on-screen bodies whose cinematic representation is distinct from the photographic realism of earlier cinema. As with *Avatar*, unprecedented techniques in motion capture technology are now being employed by visual effects industries to instill films with near photographic depictions of otherworldly characters. Motion capture works by digitally recording the live motions of an actor's body in a specialized suit enveloped with sensors. The captured data from the actor's motions can then be translated into a digital, composite figure either in real time by use of virtual camera systems, or it can be further refined into a virtual character by a team of animators (Figure 3.1). The technology allows for a digital effects team to capture the dynamism of a human body and morph it into a fictitious, digital being, such as the giant primate in Peter Jackson's *King Kong* (2005), or the Gollum creature from *The Lord of the Rings Trilogy* (2001-2003). The continuing development of special effects technology demonstrated by motion capture has in many ways, demanded a reevaluation of more traditional concepts for understanding bodily representation in film.

The representation of the computer-generated body has often been problematic for viewer perception because it does not project the same emotional depth as the live actor photographically reproduced in front of the camera. Returning once more to Giralt's "Realism and Realistic Representation in the Digital Age," the author questions whether CGI is a more authentic representation of reality than photographic film, by comparing

the types of realism inherent to those forms of representation using Andre Bazin's notion of a directorial divide in cinema.

As Bazin suggests in "The Evolution of the Language of Cinema," there are directors who attempt to film an objective reality in its purest form, and there are directors who demonstrate their trust in the image, or rather film what is objectively real in front of the camera through their own artistic subjectivity to create an invented reality.[36] To Bazin, the indexical object filmed by the camera always carries with it the subjectivity of its director, whether the object is an attempt to portray reality as it truly is, or presents a fabricated reality through special effects.[37] Analyzing Bazin's directorial schism, Giralt suggests that when CGI attempts to achieve realistic credibility, it represents a further development of illusionism in the direction of a cinematic realism, showing the technical creativity of the director rather than a documentation of reality itself.[38] Giralt refers to the Italian Neorealist film Vittorio De Sica's *Bicycle Thieves* (1948), as demonstrating the director's attempt at capturing an objective reality through the lives of poor working class citizens in postwar Italy. Conversely, Giralt suggests that in a film like Steven Spielberg's *Jurassic Park* (1993), the director has constructed a cinematic reality through digital effects.[39]

Giralt applies Bazin's directorial divide to philosopher Jose Ortega y Gasset's model for analyzing realism in *The Dehumanization of Art*. To Ortega, represented

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[36] Andre Bazin, "Evolution of the Language of Cinema," *What Is Cinema?*, trans. and ed. Hugh Gray (Berkeley: University of California Press, 1967): 23-40, 14.
[37] Ibid.
[38] Gabriel Giralt, "Realism and Realistic Representation in the Digital Age," *Journal of Film and Video*, 62. no. 3 (2010): 3-16, 14.
[39] Ibid., 5, 11.

realities in art trends of the 20th century can be measured by how an artwork elicits emotions from the viewer. A viewer can be attracted to the surface appearance of an object; the result of a superficial type of realism. Likewise, a viewer can embrace an art object with a strong level of emotional depth based on how the artist's subjectivity might parallel the viewer's own experiential reality. These emotional responses bring viewers into a closer relationship with the represented reality of an artwork, or push them further away depending on their projected response.[40] Using Ortega's model, the cinematic realism in *Bicycle Thieves* can be a deep, emotional experience in the way that its objective reality prescribes to lived experiences in the spectator's reality. By contrast, a viewer of a film like *Jurassic Park,* which coincides with the viewer's perceptual experiences of the world, is less likely to elicit an emotional relationship to the film's represented reality.[41] Similarly, in terms of realism outlined by Ortega and Giralt, the computer-generated body would project a perceptual, surface realism in which the spectator's emotional identification would certainly be limited. But with motion capture technology, viewer identification with the digital character goes beyond the body's surface appearance due to the live actor that animates the virtual body on screen.

As I have already hinted at with the unique ontological status of *Avatar*, computer-generated imagery can work cohesively with the human body through the use of motion capture technology. The technology signifies a type of superficial realism communicated to the viewer through perceptual cues from the virtual body on screen, but on a more profound level of realism, largely attributed to notions of empathy, the viewer

[40] Jose Ortega y Gasset, *The Dehumanization of Art*, for a thorough overview of Ortega y Gasset's theory see Gabriel Giralt, "Realism and Realistic Representation in the Digital Age," 9.
[41] Ibid., 11.

is emotionally attracted to how the director's subjectivity has approached the objectively real- or rather, the digital character the director has created by capturing the emotions of the actor's performance in reality.

As with any computer-generated animation, the initial challenge posed by motion capture technology is the creation of images that look photographic but whose finalized, digital representation is in theoretical terms, unable to be captured in reality by the photographic lens. But as I have already mentioned, CGI often requires a reanalysis of film that is grounded in photographic realism. To revisit the example of Cameron's volume stage used during the making of *Avatar*, live actors rigged in motion capture suits were filmed using virtual camera systems. As the actors moved and interacted with objects on the volume stage, their motions could then be captured and rendered live on the interface of a virtual camera as a computer-generated, ten-foot-tall alien of the Na'vi race. From the digital imagery captured on stage, animators at Weta Digital could then take the alien composites performed by actors and further transform their appearances using animation software. As a film like *Avatar* demonstrates, computer-generated imagery can originate from the framework of an indexical object such as the human body, but can be morphed into a non-photographable entity by way of motion capture.

In terms of the virtual body, spectators can identify with the surface realism of the motion capture performer due to the perceptually realistic qualities of the digital counterpart on screen. If we again think about motion capture in Prince's terms as a perceptually realistic image, the computer-generated body can be judged as having a photographic likeness in the way it provides visual cues to the viewer's own observable experience of the world. In recent examples of contemporary blockbuster cinema, the

virtual body has appeared unrealistic because its physical cues do not correspond to the viewer's expectations of real human motion and physical laws. In George Lucas' *Star Wars Episode II: Attack of the Clones* (2002), Yoda, a CG character whose motions have been appropriated from a human body, flips and gyrates as he battles Count Dooku (Christopher Lee) in a lightsaber duel. Yoda's physicality projects an exaggerated, nearly comical representation of a body in motion as it is unable to match accurate muscle movement. While in the Wachowski Brother's *The Matrix Reloaded* (2003), physical accuracy of the on-screen body becomes questionable when a digitally-rendered Neo (Keanu Reeves) fights hundreds of virtual copies of an agent henchman (Hugo Weaving) in the film's infamous brawl scene. The animated characteristics of the agents' virtual bodies take on an elastic quality as they get tossed into the air by a virtual Neo whose body also appears overly flexible and rubberlike.

As Lisa Purse claims in her article "Digital Heroes in Contemporary Hollywood: Exertion, Identification, and the Virtual Action Body," the active, virtual character must be understood through accurate, perceptual cues in order for the spectator to successfully identify with the body, and find satisfaction in the film's fictional content.[42] Thus the success of the viewer's investment in the virtual body highly depends on how perceptually realistic the body appears or rather, how it might successfully link to the viewer's personal understanding of a real body. As Purse suggests, the virtual body often looks unconvincing in many Hollywood films because it cannot meet the physical correspondences that the viewer has come to recognize from actual, human physicality.[43] For Purse, in order for the spectator to be able to fully identify with the CG body, the

[42] Lisa Purse, "Digital Heroes in Contemporary Hollywood: Exertion, Identification, and the Virtual Action Body." *Film Criticism*. 32. no. 1 (2007): 5-25, 10.
[43] Ibid., 11.

animator must precisely recreate perceptual cues relating to muscle flexion and contraction as well as physical forces such as momentum and impact.[44] But motion capture arguably provides a solution to the poor, physical representation of the virtual body outlined by Purse. In addition to Purse's argument, I would like to further claim that because motion capture is grounded in the indexical movement of the actor, it is perceived by viewers as a highly convincing, perceptually realistic image. Through its hybrid representational effect, the viewer can identify with the computer-generated composite as an image that accurately correlates to their own expectations of real-world bodies in motion, whether human, ape, monster, or otherwise.

The profound athleticism of the Na'vi aliens in *Avatar* is perceived by the spectator as a direct correlation to the human body running, jumping, and sprinting through a jungle environment. The virtual body of Caesar, a digital chimpanzee portrayed by actor Andy Serkis in Rupert Wyatt's *Rise of the Planet of the Apes* (2011), conveys perceptual cues that coincide with the spectator's visual understanding of both the human and chimpanzee body in motion. In the beginning of the film, Serkis performed Caesar's body to replicate the facial gestures and physical traits of a chimpanzee, but as the film progresses Serkis' gestures transform to match a hominid that stands more erect and displays human-like movements. To the viewer, Serkis' performance is dually perceived as something that is both primate and human because the actor's motions successfully correspond to active human and primate bodies in reality. It is the human actor that the computer-generated figure symbolizes that allows the motion-captured body to be interpreted as a perceptually realistic image. The hybrid representation of the technology

[44] Ibid.

provides the viewer with a rewarding emotional experience through their identification with the perceptually realistic body witnessed on screen.

Motion capture and its appearance in contemporary cinema has presented film theorists with a discourse fusing traditional concepts of cinematic representation (celluloid, photography, etc) with stunning new technologies of the digital age (CGI, virtual cameras, etc.). It is important to think of motion capture as neither a product of conventional modes of film nor an advanced offspring of computer-generated technology, but rather an amalgam of both. The technology is perceived as a hybrid form of cinematic representation in that the indexical qualities of human motion are digitally recorded and translated into the non-indexical status of certain computer-generated bodies, whether they are intended to resemble a human such as actor Jeff Bridges' nemesis lookalike Clu from *Tron: Legacy* (2010), or completely nonhuman such as the Na'vi from *Avatar* (2009). In terms of such on-screen bodies, motion capture underlines the importance of an indexical point of departure for cinematic representation in the new frontiers of digital film.

Yet as I have suggested, the cinematic realism inherent to motion capture is understood by viewers as more emotionally penetrating than a mere surface appearance of digital effects. Tanine Allison argues in her article "More than a Man in a Monkey Suit: Andy Serkis, Motion Capture, and Digital Realism," that actor Andy Serkis, underneath his motion capture attire and digital appearance of a giant ape in Peter Jackson's *King Kong* (2005), provided audiences with an authentic form of self-reflective

method acting.[45] In cinematic terms, method acting refers to a performer's attempt to conjure in themselves the emotions, mindset, and physical attributes of the character they are portraying, often bringing their own life experiences to the screen. In the same way the flesh and blood actor tries to embody the psychological nature of a famous individual in preparation for a major Hollywood biopic, Serkis' performance in *King Kong* indicates a method study of a primate who exhibits a considerably wide array of emotions; anger, jealousy, happiness, and of course, undying love for a human female. Allison also suggests that aside from Serkis' computer-generated exterior, the actor's performance "carries over" from the technology, separating itself from the on-screen spectacle that motion capture provides.[46] Serkis and his digital counterpart Kong, show that a live body utilizing motion capture is not just a digital puppeteer so to speak, but rather a method actor that provides emotional depth for the computer-generated body by adopting the role of an imaginary, yet emotionally-layered character (Figure 3.2).

Because the pixels and binary code of the computer have in obvious ways allowed film to expand from its dependency on the photograph, the potential to create a completely virtual actor or synthespian that can replace Hollywood movie stars has been an immediate concern for film theorists in the 21st century. Writing at the turn of the millennium, Barbara Creed argues in her article "The Cyberstar: Digital Pleasures and the End of the Unconscious" that the synthespian has not been exposed to the same experiences nor feels the same emotions as that of a living, breathing actor. The synthespian has never felt love, anxiety, or hatred; nor can the virtual actor harbor deep

[45] Tanine Allison, "More than a Man in a Monkey Suit: Andy Serkis, Motion Capture, and Digital Realism," *Quarterly Review of Film and Video*, 28, no. 4 (2011): 325-338, 333.
[46] Ibid.

fears and desires- terms the author uses to define the unconscious mind.[47] For Creed, processes of identification are called into question when the viewer is unable to relate to the synthespian through the same emotional and psychological qualities present in that of a live actor.[48]

But in addition to Creed's analysis of the computer-generated body, psychic identification with the virtual actor changes drastically in the context of motion capture. Unlike the synthespian, the live actor arguably brings to their on-screen performance the emotions and experiences outlined in Creed's definition of the unconscious mind. In an interview with BBC, Serkis personally commented on these emotive qualities of the live actor by stating, "What is important is that [motion capture is] understood as acting…The emotional content of these [motion capture] performances live and die by what the actors bring to the roles on set…I never approach a live action role any differently to a performance-captured role. The process of acting is absolutely identical."[49] It is my contention that the motion capture artist is no different than the traditional actor in their ability to employ personal emotions into the development of a computer-generated character. Aside from documenting the actor's motions, the technology also serves to capture the actor's emotions as they embody their digital counterpart (Figure 3.3). It is these emotions animating the virtual body that viewers identify with on an emotional level that is deeper than a mere superficiality of digital effects.

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[47] Barbara Creed, "The Cyberstar: Digital Pleasures and the End of the Unconscious," *Screen*. 41. no. 1 (2000): 79-86, 84.
[48] Ibid.
[49] Andy Serkis quoted in Chi Chi Izundu, Steven McIntosh. BBC, "Andy Serkis says special effect films should win awards," Accessed November 14, 2011. http://www.bbc.co.uk/newsbeat/14488187.

In Joseph Kosinski's *Tron: Legacy* (2010), motion capture was utilized to create an exact digital replica of actor Jeff Bridges as he appeared in Steven Lisberger's *Tron* (1982) from nearly three decades before. In the film, Bridges plays computer programmer Kevin Flynn as well as Flynn's computerized nemesis Clu- a digital facsimile Flynn creates of himself in the original *Tron* film. In order to have Bridges appear in *Tron: Legacy* as Clu from the original film, the actor wore a specialized Helmet Mounted Camera (HMC) that could record over 50 marker points evenly arranged on his face. The camera could then track Bridges' facial markers and translate them into a digital composite of the actor as he appeared in his early 30s; a figure created by Digital Domain using numerous photographs of Bridges' from several decades prior.[50] In this way, Bridges' actual performance appeared on screen as the actor as a considerably younger man (Figure 3.4).

As the film's visual effects supervisor Eric Barba comments, "Clu had to look, feel, breathe and act exactly like the young Jeff…Jeff gave us some really great performances to do that with, but it had to be a believable, realistic human- and in this case a perfect early- 1980s Jeff Bridges."[51] Although a computer-generated surface appearance of a young Jeff Bridges is perceived on screen, the underlying motions of his body are grounded in an element of indexicality; the emotive performance of the actor digitally recorded by the camera. The dynamism of a flesh and blood actor that brings emotion to their digital character satisfies viewer identification by connecting to audiences on an emotional and physic level.

[50] Walt Disney Pictures. Walt Disney Pictures, "The Making of TRON: Legacy (2010) Movie." Accessed October 27, 2011. http://www.artooz.com/featured-posts/the-making-of-tron-legacy-2010-movie/.
[51] Eric Barba quoted in "The Making of TRON: Legacy (2010) Movie."

Emotional identification with the type of realism provided by the motion-captured body can also be attributed to the way in which the spectator experiences the emotions of the digital character vicariously, or rather is able to form an empathic connection between their own feelings and that of the body on screen. In Wilhelm Worringer's seminal text *Abstraction and Empathy*, the author formulates a model of realism intended for the perception and understanding of modern art. As Worringer argues, concepts of beauty in various forms of artistic representation are determined by a viewer's ability to empathize with an art object. To Worringer, art that attempts to portray a realistic representation of the world, exemplified by the naturalistic expression of Renaissance painting and sculpture, brings about satisfaction for viewers through a perceptual understanding that "aesthetic enjoyment is objectified self-enjoyment."[52] In Worringer's terms, a viewer can perceive their own feelings and emotions in works of art that present a mimetic representation of the natural world.[53] Conversely, Worringer suggests that objects that are an abstraction from reality, namely what the author recognizes as Egyptian, Byzantine, and expressionistic art, indicate mankind's uncertainty with the world during times of socio-political and religious turmoil. During such periods of anxiety, man aspires to abstract objects from their erratic condition in reality into transcendental forms.[54]

Because the motion-captured image provides such a convincing mimesis of reality through a mixture of live motion and advanced CGI, viewers are able to identify with the on-screen, digital character through notions of empathy addressed by Worringer. In Rupert Wyatt's *Rise of the Planet of the Apes* (2011), Andy Serkis portrays the character

[52] Wilhelm Worringer, *Abstraction and Empathy: A Contribution to the Psychology of Style*, trans, Michael Bullock (London: Routledge and Kegan Paul Ltd., 1953), chap. 1.
[53] Ibid.
[54] Ibid.

of Caesar, a chimpanzee who becomes increasingly more human as the film progresses. In the film, Caesar is exposed to a new Alzheimer's drug during medical testing which can regenerate dying brain cells. As Caesar matures, the drug which has been ingrained in his DNA causes rapid evolution in his intelligence and cognitive skills. This leads Caesar to expose other laboratory-tested primates to the drug which he later recruits in a revolt against humankind. Donning motion capture attire, Serkis was able to accurately portray a simian body evolving into a more intelligent hominid; an act achieved through Serkis' emotive facial expressions, and a body language transitioning from apelike to more humanlike throughout the film.

During production, Serkis wore a dedicated motion capture suit covered with sensor points through which virtual cameras could record his performance from a variety of angles on set. Serkis' movements were then translated during live filming into the computer-generated Caesar on the display of the virtual cameras (Figure 3.5). To capture the essence of Caesar's evolution in intelligence, Weta Digital placed over 100 markers on Serkis' face and eyelids so as to document the expressions of a primate who progressively achieves heighted processes of thinking. Aside from Serkis' performance, the film also employed other motion capture artists, including acrobats from the Cirque Du Soleil troupe, to fill in for multiple simian bodies on screen.

At the film's conclusion, Caesar, accompanied by a legion of hyper-intelligent primates, battles a police and military blockade on the Golden Gate Bridge. To record the skirmish, the film's production crew built a 250'x 90' volume stage replicating an exact

section of the bridge outside the city of Vancouver.[55] Production then used mobile camera towers to record the individual nuances of each performer via the sensors on their motion capture suits. The incredible size of the volume stage allowed Weta Digital to capture a highly emotional interaction between human authorities and digital simians. As the film's visual effects supervisor Dan Lemmon observes, "We knew the apes would need to be every bit as emotionally engaging and nuanced in their performance as the humans, and there is no better way to create a rich, emotive digital character than to start with the performance of a talented actor. That performance is the foundation..."[56]

With the motion-captured performances in *Rise of the Planet of the Apes*, I want to suggest that spectators find gratification in the film's brand of cinematic realism through their ability to share the same feelings and emotions projected by the actors playing the role of the digital simians on screen. With Serkis' portrayal of Caesar, audiences do not just perceive a special effect, but also empathize with Caesar's existential suffering as an innocent creature subjected to torture and abuse in a primate holding facility. In a similar manner, when Caesar and his army of simians battle human authorities to ensure their freedom, the audience is subjected to the same feelings of militaristic passion and spirit of revolt present in that of the apes as they eradicate their human oppressors through tactical commands given by Caesar (Figure 3.6).

In one of the film's most emotionally-charged scenes, a motion-captured, silverback gorilla named Buck (Richard Ridings) saves Caesar's life by using his own body to block oncoming gunfire from a helicopter. In the process, Buck jumps onto the

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[55] Simon Gray, "Simian Rebellion," American Cinematographer, 92, no. 8 (2011): 18-22.
[56]Dan Lemmon quoted in "Simian Rebellion",18.

moving copter and subsequently causes it to crash. As Caesar pulls Buck's body out from the burning wreckage and cradles him as he dies, the spectator arguably takes part in an imagined experience of the gorilla's martyrdom, sharing not only Buck's emotional fervor as he fights to save his friend, but also a sense of his honorable sacrifice as he takes his final breath in Caesar's arms. As *Rise of the Planet of the Apes* suggests, the spectator's empathic identification with the digital character animated by a live actor, provides satisfaction in the film's representational reality.

Yet to return to the representational crisis surrounding computer-generated imagery suggested by Giralt, where does the realism characteristic to motion capture position the virtual body within Bazin's directorial divide? The representational effect provided by motion capture by no means suggests the director's attempt at filming a pure, objective reality similar to the films and documentaries of the Italian Neorealists. The technology still undoubtedly points to the director's faith in the image through the construction of invented, computer-generated realities. However, I would like to suggest that it does realign the creation of virtual bodies with more traditional modes of cinematic production, namely the documentation of an indexical object as it stands in reality. Through this indexical actor filmed in front of the camera, what we ultimately witness in motion capture technology is a cinematic realism where the virtual body is no longer just a digital effect, but also a significant filmic character through which the spectator can now inhabit the emotions and mindset of the digital construct witnessed on screen.

Figure 3.1. *The Lord of the Rings Trilogy* (2001-2003, New Line Cinema). Actor Andy Serkis performing the role of Gollum using motion capture technology. Courtesy of New Line Cinema.

Figure 3.2. *King Kong* (2005, Universal Pictures). Andy Serkis performing the role of his emotionally-layered, digital counterpart King Kong. Courtesy of Universal Pictures.

Figure 3.3. *King Kong* (2005, Universal Pictures). Andy Serkis in motion capture attire inhabiting the emotional mindset of the giant primate, King Kong. Courtesy of Universal Pictures.

Figure 3.4. *Tron: Legacy* (2010, Walt Disney Pictures). Jeff Bridges performing the character of Clu, a digital replica of himself as he appeared in *Tron* (1982). Courtesy of Walt Disney Pictures.

Figure 3.5. *Rise of the Planet of the Apes* (2011, Twentieth Century Fox Film Corporation). Andy Serkis as the chimpanzee Caesar Courtesy of Twentieth Century Fox Film Corporation.

Figure 3.6. *Rise of the Planet of the Apes* (2011, Twentieth Century Fox Film Corporation). Andy Serkis and other motion capture actors performing a spirited simian revolt on a digitally-constructed Golden Gate Bridge. Courtesy of Twentieth Century Fox Film Corporation.

Chapter Four: Feeling the Full Picture: Digital Stereoscopy and the Aesthetic of Immersion

With the unparalleled success of Cameron's *Avatar* in 2009, a film shot entirely in digital 3D, audiences were not only introduced to cutting-edge CGI and trendsetting uses of motion capture, but also to what now appears to be the rekindling of a third revolution in stereoscopic film. The first 3D theatrical boom lasting from roughly 1952-1955, initially came about when studio executives sought to find a successful means of competing against the rising popularity of television. Yet this initial prospering of 3D technology would die off nearly as quickly as it became a craze as film industries turned increasingly toward the use of the less technically troublesome CinemaScope; the ultra widescreen movie format that seemingly engulfed viewers in a panoramic view. In the early 1980s, in conjunction with an ever-expanding home video market, theatrical 3D would return once more with a series of B horror films such as *Dogs of Hell* (1982), *Friday the 13th Part III* (1982), and *Jaws 3D* (1983) for another unsuccessful stint that failed to make a lasting impact on movie audiences and again due mostly to technical inconveniences.

Prior to the release of *Avatar*, only a peppering of other films shot in 3D were introduced in the same year, most notably the stop-motion, fantasy film *Coraline* (2009), and approximately 20 or so 3D films have been released since 2005, with blockbuster titles like *Journey to the Center of the Earth* (2008) and *Beowulf* (2007) created in their entirety using digital 3D camera systems. These were soon followed by a handful of other films that were shot in 2D but had footage converted to 3D during post-production. Yet since the success of *Avatar* in digital 3D, around 30 films in 2010 were introduced in 3D,

a staggering 44 3D films presented in 2011, and already an army of 3D motion pictures are scheduled for release in 2012. With this exponential growth in the current popularity of 3D cinema, casual movie-goers and cinephiles alike need only glance at the subheadings of movie posters in any major megaplex or IMAX venue to know that stereoscopic film appears once again back in full swing.

As a medium, stereoscopic film has been traditionally marginalized by film theorists due to an understanding that the illusion of depth provided by the 3D glasses and silver screen does not in fact complement the visual narrative of the film, but instead functions solely as a commercial gimmick, taking advantage of the excitement and terror experienced by audiences when perceiving the optical trickery of filmic objects emerging from the screen and into the theater. With the golden age of 3D cinema during the 1950s as well as the 3D horror productions of the early 80s, films did just this- with few exceptions, they emphasized an aesthetic of depth linked to an aggressive quality of shocking viewers with things hurling, jumping, and being thrown directly at their face. But in its most recent upswing, the intended function of 3D film has in many ways exhibited a striking contrast from the nature of its initial boom periods.

No longer is the medium used solely for commercial gimmicks but rather has taken on a fresh visual language. Major auteurs have willingly adopted the use of digital 3D to express a certain visual narrative, witnessed in the recent 3D productions of *Hugo* (2011), *The Adventures of Tintin* (2011), as well as *Cave of Forgotten Dreams* (2010). In such examples, directors have attempted to use the illusionistic depth perceived by audiences as means to complement the aesthetic imagination of their films. Viewers now tend to perceive this digital usage of depth not as an experience of emergence but rather

as a sensation of becoming immersed into an alternate, cinematic reality. As with the computer-generated production of a film like *Avatar*, the spectatorial pleasure of engaging with the simulated reality of digital 3D is that of a newfound visual freedom. The viewer no longer focuses simply on the 3D gimmick shot that proclaims itself as such, but rather now sees digital 3D with a certain visual totality due to the manner in which filmmakers have begun to conjoin cinematic content with the illusive depth the medium provides.

As I have previously suggested, the majority of 3D films made in the 1950s and 1980s, used depth to produce the hair-raising effect of monsters coming out of the screen or a beautiful woman attempting to lean out into the theater space to steal a kiss from her audience. These analog, three-dimensional films of the 50s employed Natural Vision 3D; the anaglyph method for presenting an illusion of depth to the theater-going public. With anaglyph, a film is projected in two separate strips whose images overlap each other by way of two Polaroid light filters, one the color red and the other cyan. Cardboard glasses with corresponding colored filters over each eye are then worn by audiences to cancel out the projected filter color. When worn by viewers, these prototypical 3D glasses allow for each eye to perceive a distinct image that the brain interprets as a single picture. To audiences, the minor differences in the images witnessed by each eye appear to have varying degrees of distance between them, thus creating depth. However, because both projectors required constant and precise synchronization of the left and right eye images, the anaglyph format often resulted in bouts of poor picture quality when the images became unaligned, as well as numerous complaints from viewers suffering from eye strain and headaches.

A large number of the 3D features during the 1980s utilized Space-Vision 3D, a stereoscopic format in which two images printed onto a single film strip were ran through only one projector with a polarizing lens attached. This technique allowed for the film to stay in sync a majority of the time, producing a more stable 3D image that was easily presentable in widescreen format, but at the price of darkened picture quality due to the polarizing nature of the 3D eyewear. Similar to anaglyph, when audiences don a pair of polarized filter glasses, the two images printed on the film strip appear differently in each eye as the glasses obstruct a certain amount of light from the polarizing lens. The viewer perceives the filmic image as having depth due to the slightly dissimilar perspective seen by each eye.

The beginning of the first 3D craze in the United States began with the release of Arch Oboler's *Bwana Devil* (1952), a film loosely based on the real life happenings of a group of man-eating lions that killed several workers during the construction of the Kenya-Uganda railway at the beginning of the 20th century (Figure 4.1). The extent to which Oboler fashions a series of shots that utilize depth to terrify audiences is certainly evident in *Bwana Devil*, and this aesthetic of penetrating the theater space quickly typified 3D film production of the 1950s. As Gunther Anders-Stern observes during 3D film's initial boom phase in "3D Film and Cyclopic Effect":

> …the 3D Film is using this [depth] effect for one and only one purpose- in order to deprive man of his freedom: the spectator is carried into the world of the picture in such a way that he continually expects to be overrun, smashed, knocked out, shot at...without being allowed to defend himself against the aggression; thus,

> he is degraded to the role of a paralyzed participant who enjoys nothing but the thrill of fear…[57]

Anders-Stern's analysis nicely summarizes the medium's initial visual language and the way in which audiences willingly took delight in the illusion of objects invading their personal space. In a scene from *Bwana Devil,* a group of African tribesmen wielding spears and shields cautiously advance upon a lion in a grassy plain. As the hunters encroach onto the lions' territory, a series of gimmick shots are utilized in which the sharp points of the tribesmen's spears are aimed directly at the camera lens, followed by shots of a lion roaring and then pouncing at the camera. As another lion emerges from the brush, the viewer bears witness to a montage of close-up shots in which a lion is either pawing or jumping at the camera, interspersed with more close-up shots of a lion flailing about with actors in an effort to provide the likeness of a genuine attack.

Highly-trained circus cats aside, the scene certainly demonstrates how the "paralyzed participant" understood theatrical 3D in its early, analog form. With *Bwana Devil,* the three-dimensional objects that invaded the theater space provided viewers with the excitement of avoiding; continuously I might add, the illusion of an imminent death; whether from a stab by a spear point or a mauling from a lion. This visual language of the medium tended to satisfy viewing pleasure in the way audiences were subjected to a fantasy of life-threatening scenarios that pierced the boundary of the screen (Figure 4.2).

In part, this psychological allure that results when the 3D image regularly assaults the viewer's field of vision, describes a process of emotional command over the shock of things coming out of the screen. In his essay "The Aesthetics of Emergence," William

[57] Gunther Anders-Stern, "3D Film and Cyclopic Effect," *Philosophy and Phenomenological Research*, 15, no. 2 (1954): 295-298, 295.

Paul suggests that by penetrating the volume of the theater, theatrical 3D insists on directing our concentration to the illusory qualities of the 3D image itself.[58] To Paul, the cognitive effect experienced by spectators when viewing the 3D image results in an almost playful assessment of the unreal when objects bombard the theater space.[59] As Paul states:

> With the first threatening object flung from the screen we inevitably duck, flinch, or even close our eyes. With each successive object, we still experience the shock to our nervous systems but we also learn we can stare it down without threat of actual dismemberment. In gaining a kind of mastery over the peculiarities of our binocular vision, we gain a pleasure in confronting illusory threats precisely because we are convinced of our own integrity.[60]

This spectatorial process described by Paul, in which the viewer finds a certain satisfaction in overriding their emotional response to the 3D image, is articulated perfectly in the hyper-aggressive nature of a 3D slasher film like *Friday the 13th part III* (1982). The narrative of the 3D slasher film provides an ideal testing ground for the unreal qualities of the 3D image; in instances where the film's antagonist slays a victim, the director is provided with yet another opportunity to frighten audiences with a gimmick shot of a body part, blood, or sharp object coming out of the screen. In *Friday the 13th Part III*, each time Jason Voorhees kills a naïve adolescent in the woods surrounding Crystal Lake, the audience is confronted with a filmic trick of three-dimensional emergence: Jason moves hastily toward the camera lens with the prongs of a pitch fork; Jason fires a spear gun directly at the audience; Jason, with a chain wrapped around his fist, punches through a car window, giving the appearance of glass shards flying viciously out into the theater. In perhaps the film's most memorable scene of 3D

[58] William Paul, "The Aesthetics of Emergence," *Film History*, 5, no. 3 (1993): 321-355, 345.
[59] Ibid., 343.
[60] Ibid., 343-344.

gore, Jason even manages to grab helpless teenager Rick and squeeze his head to the point where an eye ball pops out at the audience (Figure 4.3). [61]

As Paul clearly lays out, when the audience is confronted with three-dimensional emergence in its analog form, there is often a suspension of disbelief, if only for a millisecond, until we are again reminded that the 3D images are not real as we progressively construct an emotional barricade to what is witnessed on screen. Yet in addition to Paul's argument, I want to suggest that the way in which audiences perceived 3D film before the digital turn can be ascribed to the lack of visual consistence present in the entirety of the 3D picture. In the context of emergence, the spectator is given no choice but to focus on singular 3D objects, partly because these penetrative images tend to selfishly distract the viewer from other subtle nuances of depth that might be observed in the 3D picture by ostentatiously making themselves apparent, but partly because the visual language of analog, stereoscopic film stressed only this much in its prototypical format. Thus, the rhetorical function of the emerging 3D object that unexpectedly materializes, and seemingly swallows any notion of a balanced 3D picture, forces the viewer to react to the aggressive nature of what is so readily shown. This startling announcement from the 3D object that pompously assumes itself as the center of attention, compels the viewer to question, if only briefly, the realness of the stereoscopic image; especially if it appears as an all too threatening swing from Jason's machete.

As contemporary film theorists have noted, by concentrating on the spectacularization of the emergent 3D image, filmmakers have in some regards hindered

[61] R.M. Hayes, *3-D Movies: A History and Filmography of Stereoscopic Cinema*, (Jefferson, NC and London: McFarland and Company, 1989), 96.

the creation of a synthesis between 3D technology and the narrative experience of film. Philip Sandifer in "Out of the Screen and into the Theater: 3D Film as Demo," has advanced the notion that since its inception, theatrical 3D has functioned as a demonstration of the medium's future potential as a mode of visual communication.[62] To Sandifer, stereoscopic film is and has always been paradoxical in that it contradicts the sole intentions of a communicative medium- it insists on making itself seen instead of achieving a type of transparency in which 3D technology is integral to the language of film.[63]

As Sandier further concludes, the aim of the technology is not to make the movie theater a place where spectators can inhabit a form of visual storytelling, but rather as a place of awe and allurement that is fostered by the emergent 3D image.[64] In an iconic scene from André de Toth's 3D film *House of Wax* (1953), a gentleman in a top hat and tails (Reggie Rymal) whacks a paddle ball continuously out into the theater space while spouting one-liners to the audience like: "Wow! There's someone with a bag of popcorn! Close your mouth! It's the bag I'm aiming at, not your tonsils!" (Figure 4.4). The purpose of this gimmick sequence appears not as a method to assimilate the technology into the narrative of the film, but rather exhibits 3D technology as a spectacle of astonishment that engages directly with the audience by emphasizing the space unto which the 3D object is projected. In the case of *House of Wax*, this is demonstrated not only by the trajectory of the paddle ball out into the theater, but also by the barker's metafictional dialogue with the audience that so blatantly breaks the 4th wall. The

[62] Philip Sandifer, "Out of the Screen and into the Theater: 3-D Film as Demo," *Cinema Journal*, 50, no. 3 (2011): 62-78, 64.
[63] Ibid., 77.
[64] Ibid., 78.

heightened realism of analog 3D wowed audiences with the illusion that filmic objects could essentially shatter the boundaries of the silver screen, as opposed to utilizing depth as a way of enriching the visual narrative of the film itself.

As I have previously suggested, the utilization of theatrical 3D in the digital age is beginning to describe a considerably more immersive experience than the invasive language of the technology's previous boom periods. Recent films of this digital 3D reawakening like the gory booby traps in *Saw 3D (2010)* or the man-eating fish in *Shark Night 3D* (2011), function to some extent as their analog predecessors; objects still hurtle out into the theater not unlike the 3D productions of the 1950s and 80s. Yet the way in which digital 3D productions are now perceived- as more detailed, comprehensive, and sensory stimulating experiences- has much to do with current advances in stereoscopic technology.

The most commonly used digital 3D system RealD, employs a circularly polarizing technique in which viewers wear filtered glasses that respond to digital filters synchronized with a single projector. The digital filters alternate between different levels of translucence and opacity synchronized with a projector that switches between two corresponding images; one for the left eye, and an image for the right eye that to the viewer, appears at a slightly different angle. The viewer's glasses allow light from the projected, filtered images to enter at two different angles that curve around the lenses. When the light from each image is projected onto the varying lenses, the viewer sees a different image in each eye, causing depth to be viewed in terms of a natural, binocular

effect.[65] Because the angles of light arch slightly around the lenses of the glasses, a viewer can move their head in virtually any direction without compromising the quality of the 3D picture. In terms of convenience, the RealD system replaces the miles of film reel that one previously needed for dual strip and single strip projection methods; the digital 3D film arrives mounted on a substantial hard drive which connects directly to the projector along with an attachment that partitions the left and right eye images. Witnessed in a film like *Avatar*, the RealD system can easily project a digital 4K image at resolutions up to 4096x3072, resulting in a 3D picture considerably sharper than a 1080p high-definition TV format.[66] Unlike the earlier 35mm two-projection systems that required the tedious synchronization of two separate film strips, digital 3D is able to do away entirely with the persistent headaches and deficient picture quality that came as a result of misaligned, dual strip systems. The digital 3D spectator can now feast their eyes on a crystal clear and incredibly stable stereoscopic image.

In terms of viewer perception, digital 3D has also made for significant advances in display technology. Aside from RealD, IMAX 3D employs a dual digital projection system that displays images on a massive silver screen positioned very closely to raised seating levels within the theater, allowing the spectator to become physically encapsulated within the stereoscopic picture. With IMAX 3D as well as RealD systems, a specialized, reflective silver screen is used in order to provide ample levels of light polarization when images are reflected off its surface. The outcome is a 3D picture that appears to have considerably more depth than earlier 35mm films, with images that

[65] Jake Carroll, Atomic Maximum Power Computing, "3D Cinema- How it Works," Accessed February 6, 2012. http://www.atomicmpc.com.au/Feature/174952,3d-cinema---how-it-works.aspx.
[66] Ibid.

project much further out into the theater space, and recede deeper into the screen. However, the gargantuan size and sleek, ergonomic design of the IMAX theater does not necessarily stand as the end-all of theatrical 3D experience, as the smaller, more conventional RealD screening format at most multiplex theaters has its perks. According to Rob Engle, 3D visual effects supervisor at Sony Pictures Imageworks, whose credentials include adapting Robert Zemekis' *The Polar Express* (2004) into an IMAX 3D version, both RealD and IMAX can provide spectators with vastly different ways of perceiving stereoscopic film:

> …[T]he biggest difference is that when you're in an IMAX theater, you're usually immersed in the screen without even looking at any content. Once you sit down, it takes a good turn of the head to look from one end of the screen to the other…[Y]ou generally feel like you're in the image on an IMAX screen…[I]n terms of the experience for the audience…an IMAX theater can be much more immersive…Contrast that with a [RealD] multiplex theater, where it's literally as if you were looking through a window and experiencing a deep world….[67]

For spectators, both 3D display formats undoubtedly offer a very immediate, sensual viewing experience. IMAX 3D very much provides the illusion of being dropped off in the three-dimensional frontlines of a cinematic battleground so to speak; viewers are literally placed in the center of action through the geometry of the theater space. However much of an immersive encounter RealD provides, the smaller screen and further distance from the stereoscopic image, allows the spectator to take in the 3D picture in its entirety and observe the refinements of the film's stereoscopic artistry. The spectator is able to see the limits of the screen, and frame the 3D picture as an Albertian window that provides a vista to a cinematic reality. In terms of RealD display, viewers traverse

[67] Rob Engle quoted in Eden Ashley Umble, SIGGRAPH, "Making it Real: The Future of Stereoscopic 3D Film Technology," Accessed February 11, 2012. http://www.siggraph.org/publications/newsletter/volume-40-number-1/makingitreal.

through a cinematic world as a passenger on a proverbial airbus, using the screen as a porthole (and an incredibly large porthole I should add) through which to examine an intricate, three-dimensional landscape.

The immersive nature that describes the new face of digital 3D has much to do with the way directors have approached the technology as a production tool beneficial to the narrative structure and visual style of the film. A number of contemporary directors, who have willingly embraced the advantages of digital cinema, tend to look at depth as a natural component of the filmmaking process. In an interview, the pioneer of digital stereoscopy James Cameron has observed that:

> Everybody from lizards to fish has got two eyes because survival comes from being able to gauge how far away is the prey or the predator. If I'm a frog having to shoot a bug out of the air with my tongue, I have to know how far away it is. That's how we see. Our two eyes are range finders. That's how our brains process the world. So why shouldn't movies reflect the way we visually process information?[68]

One need only experience the baffling three-dimensional craftsmanship of a film like *Avatar* to understand Cameron's constructive attitude toward the medium. The four year long production of the film necessitated cutting-edge advances in stereoscopic technology that Cameron himself had fine-tuned prior to *Avatar* with the filming of his 3D IMAX underwater documentaries *Ghosts of the Abyss* (2003) and *Aliens of the Deep* (2005). Partnered with stereographer Vince Pace, who developed a hybrid 3D camera with manually controlled convergence and inter-ocular distance for the production of *Ghosts of the Abyss* and *Aliens of the Deep*, Cameron co-invented the digital Fusion 3D camera system for the filming of *Avatar*. Cameron and Pace designed Fusion 3D as a two

[68] James Cameron quoted in Ray Zone, *3-D Filmmakers: Conversations with Creators of Stereoscopic Motion Pictures*, (Lanham, MD: Scarecrow Press, 2005), 143-144.

camera system whose technical specifics- zoom, focus, iris for both lenses, mirror control, separate convergence control for each camera, etc.- could all be manipulated by the cinematographer during live shooting, and with digital codex recorders on site, film personnel could even preview scenes shot in 3D throughout production.[69] This allowed Cameron and crew to playback 3D shots on location and refine the depth of field, lighting, and convergence as needed to create a balanced 3D composition (Figure 4.5).

Technical jargon aside, Fusion 3D allows the director to adjust various nuances of depth in each shot throughout the filming process, much like one would do with elements of lighting and traditional cinematography. Early 3D systems like Natural Vision relied on two interlocking 35 mm cameras that photographed objects from two different perspectives. The film from these two cameras would then have to be precisely aligned using the two projector system in order to get a clear stereoscopic picture. However, with the precise digital control and codex playback available with current 3D camera systems, directors are now able to tweak depth like any other production element throughout the shooting of the film.

In *Avatar*, Cameron utilizes this digitally-rendered depth to enhance, wonderfully I might add, the visual story of the film. Just as the paraplegic Jake (Sam Worthington) is able to explore the fantastical world of Pandora through the avatar he physically embodies, the viewer is able to explore the visual intricacies of Cameron's film through the 3D glasses they wear. Cameron's stereoscopic vision of the Pandoran ecosystem is conceived with a sense of visual wholeness, in which depth is coextensive across every object within the 3D picture and not just limited to contrived, set up shots (Figure 4.6). In

[69] Jay Holben, "Conquering New Worlds," *American Cinematographer*, 91, no. 1 (2010): 32-47, 32-33.

scenes featuring the hologram display of the Na'vian Home Tree used by military personnel within the human Operation Center, it appears as if a real holographic image has been placed at the spectator's fingertips; even the smallest details of the projection have been enhanced by the digital control of the 3D camera (Figure 4.7). Likewise, when the viewer is introduced to the nocturnal organisms of the Pandoran jungles, the stereoscopic shots tend to capture depth in even the subtle gradations of light radiating from the bioluminescent, jellyfish-like creatures. The way in which Cameron has envisioned the stereoscopic realm of Pandora- with a certain immediacy and three-dimensional completeness if you will - grants the spectator a godlike perspective from their theater chair. Rather than being forced to focus on a sole object protruding from the screen, with a film like *Avatar,* the viewer is given the pleasure of examining a virtual world in its entirety; they are bestowed with a macrocosmic gaze of a three-dimensional, cinematic universe.

James Cameron has been far from the only director to use depth as an immersive mode of filmic storytelling. Director Henry Selick conceived the stop-motion animation fairy tale *Coraline* (2009) entirely in digital 3D to enhance the meticulous design of the film's handmade figurines. In *Coraline*, a young girl discovers a sinister, alternate reality by crawling through a passageway locked behind a miniature door she finds tucked away in her home. According to Selick, shooting in 3D was a natural accompaniment to Coraline's transition into another realm:

> … I'd always thought about having a *Wizard of Oz* transition in *Coraline* - not quite so blatant as from colour to black and white - but 3D became the device, the story device… She [Coraline] goes down a little tunnel through a little door and comes out into this better version of her house. Ultimately the technology and the

> timing coincidentally came together in serving a storytelling purpose…[W]hat I wanted to do was avoid too many of the gag shots, the poke your eye out shots, and use the script and the film story to inform how we used 3D. The main idea was to draw the viewer into the film, as Coraline is drawn into this other world.[70]

And as a viewer, we are certainly absorbed into a three-dimensional reality chocked full of bizarre puppets and surreal set pieces. In *Coraline*, Selick, with an army of animators and cinematographers, has fashioned an all-encompassing artistic collaboration; a Gesamtkunstwerk in which every element of production functions on a level of synergy transcending the sole concept of stop-motion animation alone. Through the complementary nature of digital stereoscopy, the viewer's gaze is directed to the artistic wonder and sculptural essence of the film's mise-en-scène (Figure 4.8). And as a coextension of this handcrafted mise-en-scène, we can think of digital 3D in *Coraline* as another constituent of immersive, digital cinema that has braided itself into the film's narrative

In a similar vein, renowned auteur Martin Scorsese has also shown his allegiance to stereoscopic cinema with *Hugo* (2011), a film the director chose to imagine in its entirety using digital 3D camera systems. Scorsese's *Hugo* chronicles the adventures of an orphan who lives in a clock tower of a 1930s Parisian train station and attempts to unveil the mystery surrounding a broken automaton. By filming *Hugo* in 3D, Scorsese sought to immerse the viewer into a world perceived through the eyes of a child. In an interview with Scorsese, the director commented:

> It [3D] was about placing you inside this boy's world; the memory of a child…I thought that would be amazing in 3D plus the fact that he lives in the walls of a train station with the mechanisms of the clocks…As I lined up each shot, we had

[70] Henry Selick quoted in Neil Smith, BBC News, "Directors discuss 3D," Accessed February 14, 2012. http://news.bbc.co.uk/2/hi/entertainment/7978785.stm.

> to rethink how to tell a story with pictures…[T]he element of space really becomes part of the very fabric of the narrative…[71]

In several of the marvelous clock tower scenes in which Hugo navigates through a labyrinth of moving gears, the spectator experiences the gradations of depth in the clock tower's mechanics through the gaze of an innocent child. With the intricacies of digital stereoscopy, our perception of the world is substituted by Hugo's perception of the world. Our gaze becomes the vicarious gaze of Hugo who navigates a reality where the mundane qualities of a train station are transformed into a childlike view of the world filled with a certain magnificence and wonder; and communicated to the audience in precisely layered depth (Figure 4.9).

Yet Scorsese largely builds the visual narrative in *Hugo* around the magical, illusory qualities of cinema itself, interlacing Hugo's quest to unravel the mysteries of the automaton with a fictional biopic of pioneering French illusionist and filmmaker George Méliès (Ben Kingsley). To this end, Scorsese weaves original footage of Méliès films into the narrative structure of *Hugo*. In a memorable scene, a bitter and disillusioned Méliès, who has abandoned his passion for filmmaking, is shown a lost projection of his *A Trip to the Moon* (1902) by young Hugo. Inspired by Hugo's youthful determination and fascination with cinema, Méliès is reminded once again of a long repressed love for the illusory nature of cinema, namely his uncanny ability to fool the spectator's eye through photographic manipulation, fantastical set pieces, and early pyrotechnical effects. In another scene, Scorsese embeds footage of the Lumière Brother's *The Arrival of a*

[71] Martin Scorsese quoted in Mike Fleming, Deadline New York, "OSCAR: "Hugo" Helmer Martin Scorsese Ponders 3D Future And How "Taxi Driver" Would Have Benefited," Accessed February 15, 2012. http://www.deadline.com/2011/11/oscar-hugo-helmer-martin-scorsese-ponders-a-3d-future-and-how-taxi-driver-would-have-benefitted/.

Train at La Ciotat Station (1895) playing in a Parisian theater with a crowd of movie-goers fully enchanted by the appearance of a moving locomotive that seemingly arrives into the theater space. In these instances, Scorsese uses digital 3D as a way to reinforce this public enchantment that was so often experienced in the presence of the early cinematic image. The communicative message inherent to *Hugo* is sutured to the immersive utilization of digital 3D itself; just as Scorsese has sought to remind us of the early spectator's fascination with the illusion of the cinematic image, we might consider ourselves in a similar position when watching *Hugo* in digital 3D. The contemporary movie-goer delights in experiencing young Hugo's worldview through digitally-structured depth, similar to how early audiences undoubtedly gawked at the appearance of a moving train brought to life through a rapid succession of photographs.

Moving beyond the directorial scope of Selick and Scorsese, I want to suggest that the way in which filmmakers have recently employed digital 3D as a narrative component, directly parallels media theorist Lev Manovich's theory that cinematic realism prescribes to a history of technological addendums to the photographic image.[72] In *The Language of New Media*, Manovich considers the history of cinematic realism as one in which technological innovations (sound, Technicolor, CGI, motion capture, and most certainly digital 3D) demonstrate to the viewer "just how unrealistic the previous image was."[73] In Manovich's terms, the spectator frames digital 3D, when used in its immersive application, as a cinematic development that dismisses the two-dimensional picture plane consistent with previous cinema (and the poorer picture quality of theatrical stereoscopy in its classic forms) and exchanges it with a form of heightened realism that

[72] Lev Manovich, *The Language of New Media*, (Cambridge, MA: MIT Press, 2001), 186.
[73] Ibid.

provides a highly convincing illusion of reality, especially when compared to other technological achievements throughout the history of film. The simulation of the real that digital 3D provides has everything to do with the directorial mindset of using the medium as a production apparatus and not simply for cheap thrills. From the spectator's point of view, digital 3D engenders the ultimate cinematic illusion because the technology has become camouflaged into the very essence of the medium of film.

Placed within film's "history of addition," the directorial aim to render theatrical 3D as transparent can be thought of as yet another contribution to an ideal of cinema itself, or rather, film as a complete and perfect mimesis of reality. In his essay “The Myth of Total Cinema,” Andre Bazin proposes that since the dawn of photographic reproduction, filmmakers and inventors had envisioned cinema as a complete illusion of reality with color, sound, and every other element of being, yet would be far from developing technology capable of actualizing a total and comprehensive cinema. To Bazin, each technological transition in the history of the filmic image- from the silent to talkie; from talkie to Technicolor, and of course technologies on into the digital age- have gradually created a likeness of cinema’s original myth, or moreover, an exacting imitation of mechanically (or digitally) reproduced reality.[74]

As Bazin would have us believe, every moment in which a novel technology is appended to the cinematic image, the viewer inches ever closer to experiencing the primordial ideal of the cinematic image.[75] That is to say that Bazin, writing from the perspective of a film critic several decades prior to the digital turn, offered the notion that

[74] Andre Bazin, “The Myth of Total Cinema," What Is *Cinema*?, *trans*, and ed. *Hugh Gray* (*Berkeley*: *University of California* Press, *1967*): *234-236, 236.*
[75] Ibid., 236.

"cinema has not yet been invented," suggesting that the introduction of future technologies would continue to build upon the creation of an ultimate, cinematic illusion.[76] But in the wake of digital 3D, to what extent has the myth of a perfect, cinematic illusion been achieved? Was the invention of cinema complete when audiences piled into theaters to watch the premier of *Hugo* in 3D? Certainly the question is hypothetical, but considering the exponential growth in film technologies after the new millennium, one can only assume that future advances in digital cinema will further heighten the illusion of an ideal, cinematic reality. Yet in Bazin's terms, because contemporary filmmakers have successfully woven 3D into the very texture of film, we can begin to think about stereoscopic cinema as yet another building block in the construction of the ultimate, filmic trompe l'oeil.

The further cinema accelerates into the vast expanses of the digital age and continues to build upon the creation of Bazin's mythic illusion, the more it authenticates an ever-growing level of interaction between the public and virtual realities. But how does one define what is essentially "virtual" in a world where the binary processes of the computer have come to constitute almost every outlet of electronic media, most notably stereoscopic film? Jonathan Taylor in "The Emerging Geographies of Virtual Worlds" supplies us with three fundamental aspects that embody "virtual reality": a virtual space created via a computer program that allows for user interaction; a three-dimensional, virtual world in its entirety, created through computer-generated imagery as either an original, virtual realm or a simulation of reality; and lastly, the way in which a user

[76] Ibid.

interacts in actual time with a virtual world.[77] Stemming from these divergences of the virtual, Taylor theorizes that VR is often categorized as a "transcendent technology," meaning that the body becomes an extension of the virtual apparatus, abandoning the material self and fusing together with the virtual technology in its entirety.[78]

When we think about virtual reality as a cohesive bond between human being and technology, we often immediately think of a device like VPL Research's Data Glove from the early 1990s; an interface controller that could be fitted on the user's arm and used to interact with objects on a display screen in real time. Vintage Nintendo fans might immediately recognize VPL's prototype model from Nintendo's PowerGlove; a device that provided gamers with the ability to beat up virtual gangster henchmen in a game like *Bad Street Brawler* (1987). Just as iconic of the transcendent, virtual experience, was a device like Data General's Cyber Eye, a stereoscopic, head- mounted display that allowed its wearer to traverse virtual terrains surrounding their entire field of vision.

Likewise, the rhetoric of advanced video game technologies also tends to embody characteristics of the virtual transcendent. Rockstar's *L.A. Noire* (2011) for the PlayStation 3 console, allows gamers to navigate via controller through a computer-generated reconstruction of 1940s Los Angeles as a virtual detective. Within the confines of this virtual realm, the gamer can essentially engage in anything a detective might do in

[77] Jonathan Taylor, "The Emerging Geographies of Virtual Worlds," *Geographical Review*, 87, no. 2 (1997): 172-192, 172. Taylor derives part of this comprehensive definition from Robert J. Thierauf's *Virtual Reality Systems for Business.* Thierauf briefly mentions in his introduction that an important aspect of VR systems is to allow users to interact with a computer-generated environment and accomplish actions that the user might be physically incapable of doing in the real world. For a solid overview of Thierauf's analysis of virtual reality, please see the introduction in R.J. Thierauf, *Virtual Reality Systems for Business*, (Westport, CT: Quorum, 1995), 3-24.
[78] Ibid., 174

a major blockbuster film- commit to a reckless, high-speed chase, gun down opposing forces, and interrogate criminals- using a progression of questions that are chosen logically by the user in order to pry out a correct response (Figure 4.10). In a similar fashion, motion sensing technologies like the Nintendo Wii and Microsoft Kinect gaming systems allow viewers to utilize the entirety of their physical body to perform feats within a plethora of virtual situations on screen, from playing professional golf in *Tiger Woods PGA Tour 13* (2012) to blasting away at cyborg aliens in *Mass Effect 3* (2012). Nonetheless, it seems that the more we willingly adopt technologies of the digital age, the more we are becoming a unified "one" with the very forms of digital media that constantly surround us.

But to what extent, if any, does a technology like digital 3D present us with a transcendental, virtual reality in which viewers, through the very nature of the technology, become unified with it? Looking at Steven Spielberg's *The Adventures of Tintin* (2011), we see a quintessential expression of contemporary digital cinema; a film that showcases masterfully I should add, each of the digital technologies I have examined thus far. It has breathtaking computer-generated environments, a motion-captured cast, and exercises digital 3D as a way of truly drawing viewers into a neo-noir, comic-bookesque reality filled with exotic locales. Considering Spielberg's multi-faceted use of these digital technologies, I want to suggest that digital 3D in a film like *Tintin* works synergistically with computer-generated imagery to create a product that closely mirrors Taylor's concept of virtual transcendence.

In the film's major chase scene, a motion-captured Tintin (Jamie Bell) and Captain Haddock (Andy Serkis) attempt to retrieve a scroll from hostile enemies, peeling rubber through the streets of the computer-generated city of Bagghar mounted on a motorcycle and sidecar (Figure 4.11). The high level of perceptual realism from the film's computer-generated mise-en-scène and motion-captured characters, coupled with the immediate depth of digital stereoscopy, influences the spectator to perceive this frantic chase as if one were literally riding next to Tintin and Haddock in the process. From this synergistic effect, we can ultimately frame digital 3D as a brand of virtual reality in the way viewers physically interact with the virtual landscape perceived from these digital technologies working in unison.

Unlike the PowerGlove or a game like *L.A. Noire,* we cannot control our fate once immersed into the virtual reality of a digital 3D film. It would be absurd to think that at any point in the duration of *Tintin,* we would be able to physically enter the streets of Bagghar and subdue Tintin's opponents as a virtual being. However much we are unable to experience digital 3D with the same corporeal/technological melding that distinguishes a majority of current video game technologies, as a viewer in the company of a 3D film like *Tintin,* we do tend to interact with the virtual environment on screen through what I will refer to as a visual-haptic response.

In the presence of the digital, stereoscopic image, visual-haptics can be thought of as a synaesthesia of the senses; the spectator, more or less, can almost *feel* the filmic objects that appear as a result of the illusory depth in the image. We might think of this loosely as touching with our eyes. This visual-haptic response ultimately presents the

viewer with a fusion of the senses; an integration of perceptions that cause us to view the moving image as not simply a visual phenomenon, but rather as something that is not limited categorically to any singular sense; employing multiple passageways of sensory understanding when confronted by digital 3D. As I mentioned, the viewer cannot physically reach out into the virtual space and grab Tintin by the arm; we cannot push Tintin aside and take his motorcycle for a quick spin, but through the immediacy and immersive nature of digital 3D, we are presented with an illusion of Tintin, Haddock, and their motorcycle that appear so much like the real that the spectator might feel as if they could easily reach out and make physical contact with the images. Thinking in terms of visual haptics, it is clear to see how one could think of digital 3D as a product of the virtual transcendent. When presented with such a masterful illusion of reality in the theater space (and perhaps even more so in an IMAX theater) the spectator becomes so absorbed by the stereoscopic image that we might think of them as a participant in an amalgam of digital technology and material being. Once immersed into the virtual reality of digital 3D, the viewer perceives themselves as integrating into the technological collective through the way we mentally react to the 3D image in terms of a visual-haptic understanding of what we perceive on the screen.

As I have already explored with the social implications of *Avatar*, the immersive qualities of digital cinema can produce a negative outcome where viewers might forgo reality to dress up as one of the Na'vi. However, digital 3D presented as a type of virtual reality does not necessarily describe a dystopian vision in which the masses take simulation, technological or otherwise, to have taken over reality, leaving society unable to cope with the consequences as Baudrillard might have us believe. Writing on

holographic imagery in *Simulacra and Simulation,* Baudrillard argues that the three-dimensional, virtual simulation levels the true nature of the real through its precision resemblance to reality itself[79]:

> …holographic reproduction, like all fantasies of the exact synthesis or resurrection of the real…is already no longer real, is already hyperreal. It thus never has reproductive (truth) value, but always already simulation value. Not an exact, but a transgressive truth, that is to say already on the other side of the truth…This is perhaps why twins were deified, and sacrificed, in a more savage culture: hypersimilitude was equivalent to the murder of the original, and thus to a pure non-meaning. Any classification or signification, any modality of meaning can thus be destroyed simply by logically being elevated to the nth power - pushed to its limit, it is as if all truth swallowed its own criteria of truth as one "swallows one's birth certificate" and lost all its meaning.[80]

In Baudrillard's dystopian terms, digital 3D in several of its current theatrical contexts appears as a hyper-realistic copy of the real that tends to obliterate the very authenticity and meaning of the reality it seeks to imitate. But this is by no means the only way in which digital 3D can be read in regards to Baudrillard's notion of hyper-simulation. Take for instance, Wim Wenders' art house documentary *Pina* (2011), a film shot in digital 3D as an homage to late German choreographer Pina Bausch and her troop of dancers from the Tanztheater Wuppertal. Using 3D as a way to essentially place the viewer directly on stage with Bausch's dancers, Wenders' film documents Bausch's highly imaginative work performed in several excerpts from live, sold-out productions. In an effort to communicate the sculptural magnificence and dynamism of the performances, Wenders filmed from close angles at the front of the stage, matching the dancers' individual motions by tracking them with the lens of the 3D camera (Figure

[79] Baudrillard, "Holograms," Simulacra and Simulation, 108.
[80] Ibid.

4.12). And at times, Wenders and crew even employed a large, camera-rigged crane to maneuver around the dancers' bodies unobtrusively [81]

In his documentary *Cave of Forgotten Dreams* (2010), director Werner Herzog, after receiving top-level clearance from the French government and armed with only a four-man crew, captured in 3D the mystery and wonder of the Neolithic paintings at Chauvet Cave in southern France. In this manner, Herzog sought to use digital 3D as a way to accentuate the formal elements of the paintings and rock formations found deep within the cave's inner cloister. As Herzog comments:

> It became immediately clear that the film should be in 3-D because of the very dramatic interior of the cave…Not only are there stalactites and stalagmites and columns of crystal cathedrals, but you have a whole drama of formations, of bulges and niches and undulations, and all this was utilized by painters 32,000 years ago.[82]

Yet as Baudrillard might suggest, the simulacrum of Bausch's dancers or Chauvet's paintings presented to us in digital 3D, devalue, and essentially render meaningless, the real experience of watching these dancers live, or if given the opportunity, exploring the viscera of Chauvet's caverns in person. However, I want to argue that this is not the case with digital 3D in the context of these documentary films.

I think it is fair to suggest that in these specific instances, the hyper-imitative nature of digital 3D is not a "transgressive" reality as Baudrillard plainly puts it, but rather, the technology supplies us with a fresh way of perceiving reality that tends to hold

[81] Hanway Films, "Pina- A film for Pina Bausch by Wim Wenders-About the Movie." Accessed February 22, 2012. http://www.pina-film.de/en/about-the-movie.html.
[82] Werner Herzog quoted in Larry Rother, The New York Times, "Werner Herzog's Cave of Forgotten Dreams Filmed at Chauvet Cave-Prehistoric Cave with a Hornet on the Wall," Accessed February 22, 2012. http://www.nytimes.com/2011/04/24/movies/werner-herzogs-cave-of-forgotten-dreams-filmed-in-chauvet-cave.html?pagewanted=all.

just as much truth value as the actual thing. However much *Pina* and *Cave of Forgotten Dreams* are stereoscopic simulations, they provide us with an exclusive gaze of the world that would otherwise be unobtainable. As a civilized person, one would never have the presumption to leave their seat during a show at the Tanztheater Wupperthal and climb onto the stage to walk circles around Bauch's dancers in an effort to scrutinize their every move. Similarly, only a restricted number of archeologists and scientists have ever had the pleasures of setting foot in Chauvet Cave to bear witness to its ancient paintings. But once the viewer puts on their 3D eyewear, they witness the revelation of a reality that possesses the ability to transcend the real. They can bask in the visual delight of experiencing Bausch's troupe from the perspective of practically dancing with them, just as they are given a backstage pass to investigate the otherwise forbidden sanctuary at Chauvet. In the presence of these three-dimensional images, we are temporarily bestowed with an omniscient view of the world; a new mode of perceptual totality that rewards us through the visual information we gather from the stereoscopic picture.

Like many novel technologies that have been conceived from the birth of digital cinema, digital stereoscopy is forthrightly ambivalent in nature. On the one hand, directors still undoubtedly use it for shock value, clinging to an earlier aesthetic of objects thrusting out into the theater. But as I have demonstrated, the medium is also in a state of transitioning away from its contrived origins to a language of immersion, where viewers inhabit exciting and visually-stimulating, virtual worlds. And as digital 3D permeates into other electronic media markets such as television, Blu-ray, and the internet, the technology continues to develop its own visual rhetoric and further denotes a type of virtual reality. Because we currently appear on the cusp of the medium's

technological potential, to remove ourselves from its immersive spectacle and to observe it objectively, can present us with a difficult task. However, I want to propose that we can use the ambiguity surrounding the use of digital stereoscopy as a means to project what I see as two divergent paths for the future direction of these digital, cinematic technologies in general, which I will discuss in further detail in the concluding section of this paper.

Figure 4.1. *Bwana Devil* (1952, Gulu Productions).
A theatrical release poster for *Bwana Devil* emphasizing the emergence of objects (lion and beautiful woman) into the theater space. Courtesy of Gulu Productions.

Figure 4.2. An early 3D audience responding to the "imminent deadliness" of the emergent stereoscopic picture. Courtesy of screenmachine.tv.

Figure 4.3. *Friday the 13th Part III* (1982, Paramount Pictures). A prime example of three-dimensional emergence in the slasher film genre as Rick gets an eyeball squeezed out of his head by serial killer Jason Voorhees. Courtesy of Paramount Pictures.

Figure 4.4. *House of Wax* (1953, Bryan Foy Productions). A barker whacking a paddle ball continuously out into the theater space as to create the spectacle of a filmic object that seemingly breaks through the boundaries of the screen. Courtesy of Bryan Foy Productions and Warner Bros. Pictures.

Figure 4.5. *Avatar* (2009, Twentieth Century Fox Film Corporation). James Cameron filming with the Fusion 3D camera system on location. Courtesy of Twentieth Century Fox Film Corporation.

Figure 4.6. *Avatar* (2009, Twentieth Century Fox Film Corporation). Digital 3D stills from *Avatar* that utilize digital stereoscopy to create a sense of "visual totality." Courtesy of Twentieth Century Fox Film Corporation.

Figure 4.7. *Avatar* (2009, Twentieth Century Fox Film Corporation). A two-dimensional shot of the Home Tree stereoscopic holograph that Cameron further animates through the intricacies of the Fusion Camera System. Courtesy of Twentieth Century Fox Film Corporation.

Figure 4.8. *Coraline* (2009, Focus Features). A digital 3D shot from *Coraline* emphasizing the sculptural qualities of the film's hand-crafted puppets and set pieces. Courtesy of Focus Features.

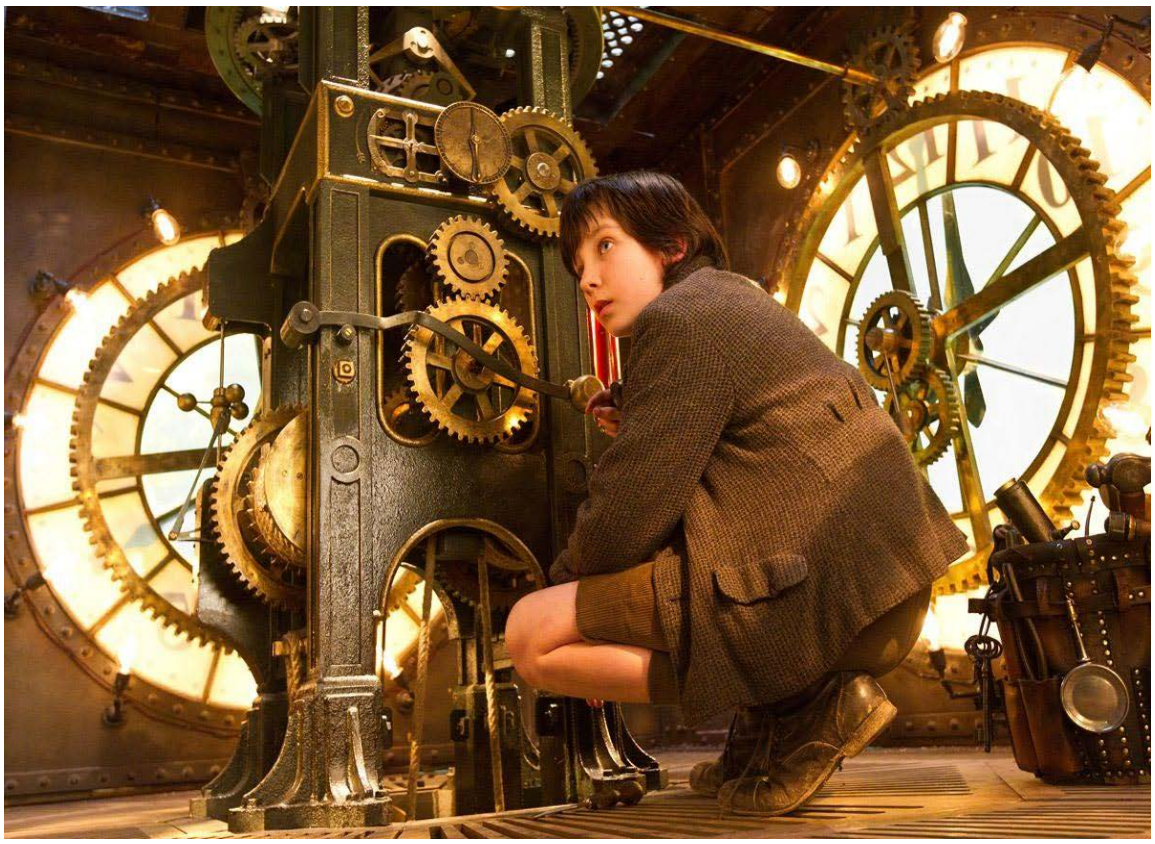

Figure 4.9. *Hugo* (2011, Paramount Pictures). A two-dimensional shot of the vicarious reality of Hugo's world. Scorsese further emphasizes the visual complexities of Hugo's clock tower dwelling through digital 3D. Courtesy of Paramount Pictures.

Figure 4.10. *L.A. Noire* (2011, Rockstar Games). Users engaging in a virtual, transcendent experience in the video game *L.A. Noire* through the act of interrogating a shady character. Courtesy of Rockstar Games.


Figure 4.11. *The Adventures of Tintin* (2011, Columbia Pictures). A motion-captured Tintin and Captain Haddock racing through the streets of the computer-generated city of Bagghar. Courtesy of Columbia Pictures.

Figure 4.12. *Pina* (2011, Neue Road Movies). Wim Wenders filming Bausch's dancers from low angles using a crane mounted with digital 3D camera systems. Courtesy of Neue Road Movies.

Conclusion: Divergent Paths for the Future of Digital Cinema

As I have continually suggested throughout the course of this paper, the paradigmatic transfer from analog to digital film has brought with it profound implications for how viewers' have come to experience the moving image in an age defined by immersive forms of cinematic technology. To better understand the future implications for the usage of these contemporary modes of digital cinema, we can return once more to our archetypal example of digital film in a movie like *The Adventures of Tintin*. As I have already discussed, *Tintin* demonstrates the optimal potential of the digital technologies outlined in this paper; we can certainly think of *Tintin* as employing digital technologies to stylistically depict the visual narrative of Spielberg's film, yet coincidentally we can also think of *Tintin* as a metaphorical showroom that displays what digital cinema and special effects industries are currently capable of performing. *Tintin*, with its synergistic blending of motion capture, CGI, and digital 3D can be thought of as one specific direction that these digital, cinematic technologies are currently taking; they can be utilized strictly for entertainment purposes. With *Tintin,* digital cinema provides the spectator with a whimsical distraction from reality; a virtual realm that immerses the viewer into its architecture through these compelling forms of digital representation. As obsessive fans of *Avatar* might suggest, using these digital technologies purely for entertainment can obviously generate a negative response from the public in providing a hyper-realistic simulation that in some instances, might begin to replace the viewer's previous knowledge constructs of the reality that surrounds them.

However much this might be the case with *Avatar*, a Baudrillardian reading of digital cinema does not yet appear to be the norm for the medium, at least not now. Instead, we should try to think about digital film's purpose to entertain as something that has embodied the very essence of cinema since its earliest appearances; that being the fabrication- whether constructed in a Hollywood studio or by computer software- of an illusory representation of reality. Just as Georges Méliès delighted early cinema audiences by making aliens seemingly vanish into thin air using stop-trick photography in his *A Trip to the Moon* (1902), or when audiences literally jumped at the thrill of witnessing the moving image of a locomotive in the Lumière Brothers *The Arrival of a Train at La Ciotat Station* (1895), we also might think of Cameron's digitally-constructed Pandoran jungles in a similar light. These digital technologies continue cinema's longstanding tradition of entertaining the public sphere through the magic of the medium; the grand illusion of the moving picture that causes us to revel in the excitement of being tricked; of having our eyes fooled into thinking the reality represented on screen appears every bit as real as the world outside the theater.

If one current direction of digital cinema gravitates toward entertainment purposes, then we might think of its other divergent path as leading ever closer to a form of technologically-mediated enlightenment, or rather, a type of democratization of the digital, cinematic image. As I have previously outlined, digital 3D used in the context of documentary film has the potential to show the viewer a simulated vision of reality that they might never otherwise experience, like navigating the cavernous passageways at Chauvet or sitting first row at the Tanztheater Wupperthal. Digital cinema does not necessarily result in the auracratic destruction of reality like Benjamin and followers of

Marxist thought have for so long proposed, but instead has the potential to diffuse a shared, visual knowledge to the world, where even the most underprivileged are bestowed with a form of cultural awareness; of course made all the more exciting and watchable through the immediacy of the digital 3D image.[83] Digitally-simulated environments do not always connote a depreciation of the real as Baudrillard tells us. These virtual realms just as easily possess the ability to mediate an experiential and illuminating fragment of reality to those individuals not positioned in the status of cultural elite. In this sense, we are truly presented with an argument of economics; for those unable to afford the expenses of traveling internationally and purchasing tickets to high-class, cultural venues, one can simply purchase a ticket to their local multiplex and watch in digital 3D an opera performance, dance documentary, or any other artistic enterprise that might never get to be experienced by the viewer in reality. Certainly, it is fun to grip the theater chair and gaze, jaw-agape at Tintin and Captain Haddock race through a fictional, Moroccan city. But just as easily we might imagine a day when all of us will be able to tour the galleries of the Louvre in a documentary heighted through the grandeur of digital stereoscopy, and all for the price of a movie ticket.

[83] By suggesting the term "aura," I am referring to Walter Benjamin's seminal essay "The Work of Art in the Age of Mechanical Reproduction" in which the author suggests that photographic reproduction as well as the mass proliferation of the photographic image, decays an artwork's aura, or the essential originality and authenticity of an artwork that has not been photographically reproduced. For Benjamin's argument in its entirety, see Walter Benjamin, "The Work of Art in the Age of Mechanical Reproduction," *Illuminations: Essays and Reflections*, (New York: Schocken Books, 1968).

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